

Canada

OPIC - CIPR 181

Industrie Canada

Industrie Canada

Notice: This application is as filed and may therefore contain an incomplete or specific application.

(57) 13 Claims

(30) (DE) P 44 21 823.0 1994/06/22

(71) BASF LACKE + FARBE AG - Germany (Federal Republic of) ;

(72) Meyer, Bernd - Germany (Federal Republic of) ;
Metzenburg, Uwe - Germany (Federal Republic of) ;
Nienhau, Egbert - Germany (Federal Republic of) ;

(54) Coating Composition Comprising at Least 3 Components,
Processes for Its Preparation, and Its Use

(19) (CA) APPLICATION FOR CANADIAN PATENT (12)

(51) Int. Cl. C09D 133/02; C09D 167/00; C09D 175/04

(43) 1995/12/28
(86) 1995/06/16
(21) (A1) 2,190,286

Ottawa Hull K1A 0C9

PROPERTY OFFICE
CANADIAN INTELLECTUAL
OFFICE DE LA PROPRIETE
INTELLIGENTIELLE DU CANADA

OPIC



coating compositions based on hydroxyl-containing 20 binders and isocyanato-containing crosslinking agents, which are employed in the field of automotive refinishing and are conventional, i.e. are dissolved in organic solvents, customary represent multicomponent systems. One component contains the binder, if desired pigments and fillers, and conventional auxiliaries and additives, and the other component contains the crosslinking agent. In addition, an adjustment additive consisting 25 of a mixture of different crosslinking agents.

in refinishing, for the coating of plastics, and as compositions and to the use of the coating compositions 15 processes for the preparation of these coatings to a present invention relates, furthermore, to a topcoat or filler.

and on an isocyanato-containing crosslinking agent. The present invention relates to a coating composition comprising at least three components and based on a hydroxyl- and carboxyl-containing polymer which is 10 dissolved or dispersed in one or more organic solvents, and on an isocyanato-containing crosslinking agent.

5 process for its preparation, and its use 10 coating composition comprising at least 3 components,

BASF Lacke + Farben Aktiengesellschaft

PAT 94 494 - 14.06.1994

However, it is the aim of the coatings industry, on ecological and economic grounds, to replace as great as possible a proportion of the organic solvents employed in coating materials by water. For the coating of motor vehicles, in particular, there is a great need for aqueous coating materials. This applies both to the area of automotive production-line finishing and to the area of automotive refinishing.

solvents is prepared in order to adjust the coating composition to the desired viscosity.

25 TWO-layer coatings are currently produced by the wet-on-wet method, in which a pigmented basecoat is initially applied and the resulting basecoat is without a baking step, it is covered with a clearcoat, and then basecoat layer and clearcoat layer are cured

In this context aqueous coatings compositions are employed in particular in the area of topcoats which are used to produce the topmost coat. This topmost coat may comprise one or more layers, especially two layers. Two-layer topcoats are composed of a pigmented basecoat layer and of a clearcoat layer which is pigmented either not at all or only with transparent pigments and is applied over the basecoat layer.

mechanical properties required.

25 these low temperatures, to films having the good (generally $< 80^{\circ}\text{C}$) and lead, even when fully cured at employed are able to cure fully at low temperatures additional requirement that the coating compositions additively required refinishes here is the

20

of hardness) and good weathering resistance.

20 solvent boil, good topcoat appearance and a high degree of appearance (good evenness, high gloss, low tendency to and they must give baked coating films of good be obtained with 1 to 2 spray passes (cross-passes), high enough for coating films of adequate thickness to purpose their solids content at spray viscosity must be by spraying using automatic spraying units. For this topcoat compositions must be capable of being applied to basecoat compositions containing special-effect pigments or 10 pearlescent pigments) are employed. Furthermore, the metallic pigments, especially aluminum flakes or basecoats containing special-effect pigments (eg. This applies in particular to coatings in which layer, least coatings of poor appearance be obtained. partially dissolved nor otherwise disturb the basecoat applied to the as yet uncured basecoat must never be basecoat and the clearcoat, the clearcoat which is 5 together. This method is very advantageous in economic terms, but places stringent requirements on the basecoat and the clearcoat, the clearcoat which is partially dissolved nor otherwise disturb the basecoat applied to the as yet uncured basecoat must never be

polyurethane coating compositions which comprise a hydroxyl-containing polyacrylate resin, dispersed in water, and a polyisocyanate component. However, these water, and a polyisocyanate component. However, these 5 great disadvantages with respect to gloss, relaxation (low graininess of the coating), tendency to solvent 10 of weathering resistance, in particular with respect to soil and, because of this, spray safety, and in respect to 15 240 h), processability (fall in viscosity and too short a pot life) and hardness.

Furthermore, DE-B 25 07 884 discloses a process for the preparation of aqueous coating compositions, in which 20 first of all a solution of a carboxyl-containing polyacrylate and/or polyester in an organic solvent is prepared, if desired, crosslinking agents, and also pigments and fillers, are dispersed in the organic 25 solvent, and the resulting dispersion, following neutralization of the carboxyl groups of the binder, is

dispersed in water.

Moreover, this distillative removal of the solvent can only be carried out at the premises of the manufacturer. Additionally, this distillative step results in additional cost. 25 After preparation of the aqueous dispersions, this solvent has to be removed byazeotropic distillation. This A disadvantage of this process is that the organic

solvent has to be removed byazeotropic distillation. This 20 additional process step results in aqueous dispersions. This solvent has to be removed byazeotropic distillation. This 25 A disadvantage of this process is that the organic solvent has to be removed byazeotropic distillation. This

EP-A-368 499, however, have the disadvantage of
These aqueous coating compositions known from

25 adjusted with water to the desired viscosity.
The coating composition with a curing catalyst, and is
mixed with a admixed shortly before the application of
the crosslinking agent in an organic solvent. This
are prepared by first of all preparing the binder and
amine/formaldehyde resins. These coating compositions
20 polyesters, and, as crosslinking agents,
binders, polyethers or ether group-containing
compositions which contain, as hydroxyl-containing
finaly, EP-A-368 499 discloses aqueous coating
finally, EP-A-368 499 discloses aqueous coating

15

refinishing.

300°C, and are therefore unsuitable for the area of
cure only at elevated temperatures of between 100 and
These coating compositions described herein therefore
polyisocyanates, epoxy resins and/or amine resins.
10 compositions described in DE-B 25 07 884 are blocked
The crosslinking agents employed to prepare the coating
lives of at least 24 months are required.

5 . automatic refinishing, where in fact very long shelf-
frequently leads to problems especially in the area of
store the finished, aqueous coating materials, which
customer. It is therefore necessary to transport and
of the coating compositions, and not at those of the

2190286

least meet the requirements which are customarily
-> 80°C) and should lead to coatings which at the very
should be fully curable at low temperatures (generally
suitable for the area of automotive refinishing, i.e.
25 Furthermore, the novel coating composition should be

coatings.
improved weathering resistance of the resulting
enhanced spray safety, improved fluidity and an
(low grittiness), lower tendency to solvent boil,
improved evenness, improved gloss, improved relaxation
based on aqueous acrylic copolymer dispersions,
ensure, in comparison with aqueous coating compositions,
films. The novel coating composition should above all
improved properties and/or gives improved coating
coatings known from EP-B-358 979, has
relation to the aqueous two-component polyurethane
provide an aqueous coating composition which, in
10 The object of the present invention is therefore to

stabiliy of the resulting coatings.
additonal disadvantage is the inadequate weathering
unsuitable for the area of refinishing. A final,
cure only at elevated temperatures and are therefore
clearcoats. In addition, these coating compositions
therefore not suitable for the production of
components of the coating composition. They are
completely inadequate compatibility of the individual

250 mg of KOH/g and an acid number of from 5
1000 and 30,000, an OH number of from 30 to
number-average molecular weight of between
organic, water-dispersible solvents and has a
25
dissolved or dispersed in one or more
containing polyester resin (A2) which is
(A2) at least one hydroxyl- and carboxyl-.

20
200 mg of KOH/g and an acid number of from 5
1000 and 30,000, an OH number of from 40 to
number-average molecular weight of between
organic, water-dispersible solvents and has a
15
dissolved or dispersed in one or more
containing acrylate copolymer (A1) which is
(A1) at least one hydroxyl- and carboxyl-.

10
1.) component (I) contains as binder (A)
outset, which is characterized in that
coating composition of the type mentioned at the
This object has surprisingly been achieved by the
5 10-days in a constant climate).

5
impacts) and good weathering resistance (5 mgI after
gloss (25 E at 20°), a high degree of hardness (210
composition should therefore, for example, exhibit good
placed on an automotive reflector. The coating
-

3.) component (III) is essentially binder-free and

desirred, at least one amine resin (F3), and
25 least two epoxide groups per molecule and/or, if
of at least one epoxide compound (F2) having at
at least one further crosslinking agent consisting
in one or more organic solvents, and, if desired,
(F1) which is, if desired, dissolved or dispersed
20 at least one nonblocker di- and/or polyisocyanate
component (II) contains as crosslinking agent (F)

has a viscosity at 23°C of <= 2.5 dPAs,
15 etoxyethyl propionate
(A4) being selected such that a 50% strength solu-
tion of the binder (A) in
the binders (A1) and/or (A2) and/or (A3) and/or
- (A4) if desired, at least one further binder,

10 to 150 mg of KOH/g, and
200 mg of KOH/g and an acid number of from 5
1000 and 30,000, an OH number of from 20 to
number-average molecular weight of between
5 organic, water-dispersible solvents and has a
dispersed or dispersed in one or more
containing polyurethane resin (A3) which is
(A3) at least one hydroxyl- and carboxyl-

to 150 mg of KOH/g, and/or

contains water.

The present invention relates, furthermore, to a process for the preparation of these coatings in refinishing, for the coating of plastics, and as compositions and to the use of the coating compositions in refinishing, for the coating of plastics, and as topcoat or filler.

It is also surprising that the coating compositions according to the invention can be prepared from the least three components by simple mixing without the necessity of complex apparatus for mixing and/or

Furthermore, the coating compositions according to the invention ensure a high degree of variability since it is possible to employ not only crosslinking agents, pigments and additives which are recommended for aqueous coatings but also crosslinking agents, pigments and additives which are employed in aqueous coatings compositions which are also crosslinking agents, pigments and additives which are employed in conventional systems.

10 A further advantage is that the aqueous coating compositions prepared from the at least three solvents (VOC = volatile organic content ≤ 2.8 pounds per gallon), although the coating compositions are prepared with the use of crosslinking agents and binders dissolved or dispersed in organic solvents. Moreover, the coating compositions according to the invention lead surprisingly to coatings having high hardness, good fullness, good evenness, a high degree of gloss, good fullness, good evenness, a high degree of hardness, low tendency to solvent boil and good

15 water-releasing resistance.

dispersing. The coating compositions according to the invention are therefore particularly suitable for the area of automotive refinishing, since the coating compositions can be prepared by the coater, directly prior to application of the coating compositions, by simple mixing of the components and can be cured at low temperatures.

to 150 mg of KOH/g, and/or
30 to 250 mg of KOH/g and an acid number of from 5
of between 1000 and 30,000, an OH number of from
solvents and has a number-average molecular weight
dispersed in one or more organic, water-dispersible
polyester resin (A2) which is dissolved or
(A2) at least one hydroxyl- and carboxyl-containing

to 150 mg of KOH/g, and/or
40 to 200 mg of KOH/g and an acid number of from 5
of between 1000 and 30,000, an OH number of from
solvents and has a number-average molecular weight
dispersed in one or more organic, water-dispersible
acrylate copolymer (A1) which is dissolved or
(A1) at least one hydroxyl- and carboxyl-containing

coatings as binder (A)
the coating composition according to the invention
It is essential to the invention that component (I) of

first of all be described in more detail.
coating composition according to the invention will
In the text below, the individual components of the
5

which correspond to those of conventional coating com-
invention are distinguished by very good shelf-lives
Finally, the coating compositions according to the
positions.

polymerization in an organic solvent or a solvent
acrylate copolymers which are obtainable by
as component (A1) it is also preferred to employ

25

preferably a viscosity of ≤ 2.0 dPAs.
propionate, have a viscosity at $23^\circ C$ of ≤ 3.0 dPAs,
which, as a 50% strength solution in ethoxyethyl
suitable. It is preferred to employ acrylate copolymers
numbers, acid numbers and molecular weights are
(A1), all acrylate copolymers having the indicated OH
As hydroxyl- and carboxyl-containing acrylate copolymer

2.0 dPAs.
2.5 dPAs, preferably of less than or equal to
has a viscosity at $23^\circ C$ of less than or equal to
solution of the binder (A) in ethoxyethyl propionate
are selected in this context such that a 50% strength
The binders (A1) and/or (A2) and/or (A3) and/or (A4)
10

(A4) if desired, a further binder.

to 150 mg of KOH/g, and
20 to 200 mg of KOH/g and an acid number of from 5
of between 1000 and 30,000, an OH number of from
solvents and has a number-average molecular weight
dispersed in one or more organic, water-dispersible
polyurethane resin (A3) which is dissolved or
(A3) at least one hydroxyl- and carboxyl-containing

5

acid having 5 to 18 carbon atoms per molecule or, glycidyl ester of an α -branched monocarboxylic acrylic acid and/or methacrylic acid with the

25 a5) if desired, at least one reaction product of

per molecule, and/or
monocarboxylic acids having 5 to 18 carbon atoms
a4) if desired, one or more vinyl esters of α -branched

20

(a6), or a mixture of such monomers, and
copolymerizable with (a1), (a2), (a4), (a5) and
at least one carboxyl group per molecule and is
a3) an ethylenically unsaturated monomer which carries

15

monomers,
different from (a5), or a mixture of such
with (a1), (a3), (a4), (a5) and (a6) and is
essentially carboxyl-free which is copolymerizable
at least one hydroxyl group per molecule and is
a2) an ethylenically unsaturated monomer which carries

10

(a5) and (a6), or a mixture of such monomers,
(a6) and is copolymerizable with (a2), (a3), (a4),
which is different from (a2), (a3), (a4), (a5) and
a1) an essentially carboxyl-free (meth)acrylic ester

5

polymerization initiator, of
mixture, and in the presence of at least one

In order to prepare the polyacrylate resins employed in accordance with the invention it is possible to employ as component (a1) any essential ally carboxyl-free ester of (meth)acrylic acid which is copolymerizable with (a2), (a3), (a4), (a5) and (a6), or a mixture of such (meth)acrylic esters. Examples are alkyl acrylates and alkyl methacrylates having up to 20 carbon atoms in the alkyl radical, for example methyl, ethyl, propyl, butyl, ethylhexyl, stearyl and lauryl acrylate and methacrylate, and cycloaliphatic (meth)acrylic acid and methacrylate.

(a1), (a2), (a3), (a4), (a5) and (a6) being selected in nature and quantity such that the polyacrylate resin (A1) has the desired OH number, acid number and the desired molecular weight.

Instead of the reaction product, an equimolar quantity of acrylic and/or methacrylic acid, which is then reacted, during or after the polymerization reaction, with the glycidyl ester of an α -branched monocarboxylic acid having 5 to 18 carbon atoms per molecule,

As component (a1) it is also possible to employ ethyltriethylglycol (meth)acrylate and methoxoligoglycol (meth)acrylate having a number-average molecular weight of preferably 550, or other ethoxylated and/or propoxylated, hydroxyl-free (meth)acrylic acid derivatives.

As component (a2) it is possible to employ ethylene-
ally unsaturated monomers which carry at least one
hydroxyl group per molecule and are essentially
carboxyl-free, and which are copolymerizable with (a1),
(a2) [sic], (a3), (a4), (a5) and (a6) and are different
from (a5), or a mixture of such monomers. Examples are
of another α,β -ethylenically unsaturated carboxylic
acid. These esters may be derived from an alkylene
glycol which is esterified with the acid, or they may
be obtained by reacting the acid with an alkylene
oxide. As component (a2) it is preferred to employ
hydroxyl esters of acrylic acid, methacrylic
acid, in which the hydroxyl group contains up to
20 carbon atoms, reaction products of cyclic esters,
for example ϵ -caprolactone and these hydroxyl esters and/or
esters, or mixtures of these hydroxyl esters and/or

Examples of such hydroxyalkyl esters are 2-hydroxyethyl acrylate, 2-hydroxypropyl acrylate, 3-hydroxypropyl acrylate, 2-hydroxypropyl methacrylate, 3-hydroxypropyl methacrylate, 2-hydroxyethyl methacrylate, 4-hydroxybutyl acrylate, 4-hydroxybutyl methacrylate, hydroxybutyl acrylate and hydroxystearyl methacrylate. Corresponding esters of other unsaturated acids, for example ethacrylic acid, crotonic acid and similar acrylic acid esters (A) are obtained if trimethylolpropane acrylate resins (A2). The proportion of trimethylolpropane component (A2). The proportion of trimethylolpropane monovalyl ether is customary from 2 to 10% by weight, based on the monomers (A1) to (A6) which are employed to prepare the polyacrylate resin. In addition, however, it is also possible to add resin to the monomers which are employed to prepare the trimethylolpropane polyacrylate resin, of trimethylolpropane monovalyl ether to the trimethylolpropane polyacrylate resin, such as olefinically unsaturated polyols, such as the trimethylolpropane monovalyl ether in particular, may be employed as sole hydroxyl-containing monomers, but, 25 trimethylolpropane monovalyl ether in particular, may be employed as sole hydroxyl-containing monomers, but, 25

e-caprolactone-modified hydroxyalkyl esters.

20 As component (a4), one or more vinyl esters of α -branched monocarboxylic acids having 5 to 18 carbon atoms in the molecule are employed. The branched monocarboxylic acids can be obtained by reacting formic acid or carbon monoxide and water with olefins in the presence of a liquid, strongly acidic catalyst; the hydrocarbons, such as mineral oil fractions, and may contain both branched and straight-chain acrylic and/or cycloaliphatic olefins. The reaction of such olefins

As component (3) it is possible to employ any ethylenically unsaturated monomer which carries at least one carboxyl group per molecule and is copolymerizable with (1), (2), (4), (5) and (6), or a mixture of such monomers. As component (3) it is preferred to employ acrylic acid and/or methacrylic acid. However, it is also possible to employ other ethylenically unsaturated acids having up to 6 carbon atoms in the molecule. Examples of such acids are ethacrylic acid, crotonic acid, maleic acid, fumaric acid and itaconic acid. It is also possible to employ maleic anhydride. It is also possible to employ succinate and mono (meth)acryloyloxyethyl maleate, as component (3) mono (meth)acryloyloxyethyl maleate to employ acrylic acid and succinate and mono (meth)acryloyloxyethyl phthalate.

in particular, proportionately in combination with others of the hydroxyl-containing monomers mentioned.

commercially under the name "Cardura E10".
verbalic acid. This glycidyl ester is obtainable
and/or methacrylic acid with the glycidyl ester of
prefered to employ the reaction product of acrylic
polymerization reaction. As component (a5) it is
carried out prior to, during or after the
carboxylic acid having a tertiary carbon atom can be
or methacrylic acid with the glycidyl ester of a
under the trade name "Cardura". The reaction of acrylic
highly branched monocarboxylic acids are obtainable
atoms per molecule is employed. Glycidyl esters of
a-branched monocarboxylic acid having 5 to 18 carbon
and/or methacrylic acid with the glycidyl ester of an
as component (a5), the reaction product of acrylic acid
15
20
25

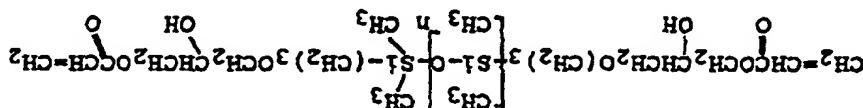
atoms, which are branched at the a carbon atom.
aliphatic monocarboxylic acids, having 9 to 11 carbon
available - to employ vinyl esters of saturated
It is particularly preferred - owing to the ready
acids, for example by reacting the acid with acetylene.
can also be prepared in a manner known per se from the
tetramer and diisobutylene. However, the vinyl esters
starting materials are propylene trimer, propylene
quaternary carbon atom. Examples of other olefinic
carboxyl groups are located predominantly on a
produces a mixture of carboxylic acids in which the
with formic acid or with carbon monoxide and water
5
10
15

As component (a6) it is possible to employ all essential
ally carboxyl-free ethylenically unsaturated monomers
which are copolymerizable with (a1), (a2), (a3), (a4)
and (a5) and are different from (a1), (a2), (a3) and
(a4), or mixtures of such monomers. It is preferred to
employ as component (a6) vinylaromatic hydrocarbons
such as styrene, α -alkylstyrene and vinyltoluene.
As component (a6) is also possible to employ, in
combination with other monomers mentioned as being
suitable as component (a6), polyisobutylene macromonomers.
Suitable polyisobutylene macromonomers are those having a
number-average molecular weight of from 1000 to 40,000,
preferably from 2000 to 10,000, and on average from 0.5
to 2.5, preferably from 0.5 to 1.5, ethylenically
unsaturated double bonds per molecule. Examples of
suitable polyisobutylene macromonomers are those described
in DE-A 38 07 571 on pages 5 to 7, in DE-A 37 06 095 in
columns 3 to 7, in EP-B 358 153 on pages 3 to 6 and in
US-A 4,754,014 in columns 5 to 9. Also suitable are
the above-mentioned molecular weights and contents of
other acryloxyisobutylene-containing vinyl monomers having
ethylenically unsaturated double bonds, for example
functional silanes with epichlorohydrin and then
reacting the reaction product with methacrylic acid
and/or hydroxylalkyl esters of (meth)acrylic acid.

As component (a6) it is possible to employ all essential
ally carboxyl-free ethylenically unsaturated monomers
which are copolymerizable with (a1), (a2), (a3), (a4)
and (a5) and are different from (a1), (a2), (a3) and
(a4), or mixtures of such monomers. It is preferred to
employ as component (a6) vinylaromatic hydrocarbons
such as styrene, α -alkylstyrene and vinyltoluene.
As component (a6) it is also possible to employ all essential
ethylenically unsaturated monomers which can be prepared by
reacting the above acryloxyisobutylene-containing vinyl
monomers having ethylenically unsaturated double bonds
with epichlorohydrin and then reacting the reaction
product with methacrylic acid.

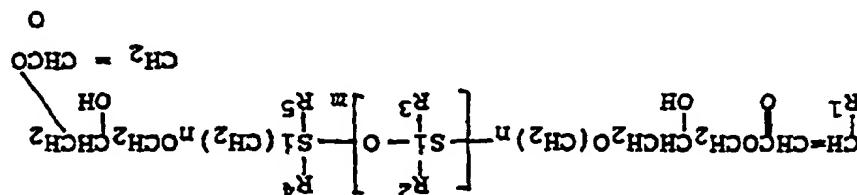
20 publication number WO 92/22615 on page 12, line 18, to
in the international patent application having the
suitable as component (a6) are the compounds mentioned
other examples of polyisiloxane macromonomers which are

15 viscosity of 240 mPa.s (25°C).
equivalent, an OH number of 102 mg of KOH/g and a
where $n \approx 9$, having an acryloy equivalent of 550 g per



10 organofunctional polydimethylsiloxane of the formula
It is particularly preferred to employ the α,ω -acryloy

20 $n =$ from 8 to 30
 $a =$ from 2 to 5, preferably 3
radical.
carbon atoms, especially methyl, or phenyl
aliphatic hydrocarbon radical having 1 to 8
 $R^2, R^3, R^4, R^5 =$ identical or different
where $R^1 = H$ or CH_3



15 polyisiloxane macromonomers of the following formula:
It is preferred as component (a6) to employ

(a3) from 1 to 15% by weight, preferably from 2 to 8%

35% by weight, of component (a2),

25 (a2) from 10 to 40% by weight, preferably from 15 to

50% by weight, of component (a1),

(a1) from 20 to 60% by weight, preferably from 30 to

20 polymerization of

employed with particular preference are obtained by
transistor temperature. Acrylic resins which are
has the desired OH number, acid number and glass
[sic] selected such that the polycrylic resin (A1)
15 The nature and quantity of components (a1) to (a6) is

coating composition.

The use of such polyisiloxane macromonomers leads to an
improvement in the slip of the aqueous polyurethane

10

copolymer (A1).

The monomers which are employed to prepare the
by weight, based in each case on the overall weight of
weight and with particular preference from 0.05 to 0.8%
than 5% by weight, preferably from 0.05 to 2.5% by
employed to modify the acrylic copolymers (A1) is less
The quantity of the polyisiloxane macromonomer (s) (a6)

page 18, line 10.

15 The preparation of the polyacrylate resins (a1)

10 by weight, of component (a6),
(a6) from 5 to 30% by weight, preferably from 10 to 20%

5 by weight, of component (a5), and
(a5) from 0 to 25% by weight, preferably from 5 to 15%

by weight, of component (a4),
(a4) from 0 to 25% by weight, preferably from 5 to 15%

by weight, of component (a3),

25 polyacrylate resins which are obtainable by propoxides. If it is preferred, therefore, to employ aqueous coating compositions having better processing two-stage process, since in this way the resulting the polyacrylate resin (A1) is preferably prepared by a

20 propionate and isopropoxypropanol.
160°C. The solvents employed are preferably ethoxyethyl temperature of from 80 to 160°C, preferably from 110 to the polymerization is advantageously carried out at a

15 by weight, based on the overall weight of the monomers. by weight and with particular preference from 4 to 10% are employed preferably in a quantity of from 2 to 25% butyronitrile and t-butyl perbenzoate. The initiators t-butyl perethoxyhexanoate, benzoyl peroxide, azobisiso- are initiators which form free radicals, for example examples of polymerization initiators which can be used 10 solvent.

5 merization, at least in part [lacuna] water-dilutable (A1) first of all in a solvent which is not water-dilutable and to replace this solvent, after the poly- is also possible to prepare the polyacrylate resins methoxypropyl acetate and the like. In this context it derivative based on propylene glycol, for example ethyl ethoxypropionate, isopropoxypropanol, 2-hydroxypropionate and 3-methyl-3-methoxybutanol, and diethyl ether, diethylene glycol monobutyl ether, ethyl

(a1) and (a6).

(a4) and (a5) and, if desired, portions of components
of the solvent and about 10% by weight of component
for example, initially to charge at least 20% by weight
25 these components as described above. It is preferred,
portion of the solvent, and to add the remainder of
components (a4) and/or (a5) together with at least one
to include in the initial charge only portions of
20 remaining components. Furthermore, it is also possible
least a portion of the solvent and to meter in the
charge components (a4) and/or (a5) together with at
least a portion of the solvent and to add the
remaining components, however, it is also possible initially to

15 polyacrylate resin.

at least partially neutralizing the resulting
III. After the end of the polymerization, if desired,

10 (a6) and continuing polymerization, and
portion of components (a1), (a2), (a4), (a5) and
(a6) has been added, adding (a3) and any remaining
remaining composed of (a1), (a2), (a4), (a5) and if desired
II. After at least 60% by weight of the mixture

5 solvent,

I. Polymerizing a mixture of (a1), (a2), (a4), (a5) and (a6) in an organic
and (a6) or a mixture of portions of components
and (a1), (a2), (a4), (a5) and (a6) in an organic

Also preferred is the preparation of the polyacrylate resins (A1) which are employed in accordance with the invention by a two-stage process in which stage (I) lasts from 1 to 8 hours, preferably from 1.5 to 4 hours, and the addition of the mixture of (3) and any remaining portion of components (a1), (a2), (a4), (a5) and (a6) is made over a period of from 20 to 120 min, preferably over a period of from 30 to 90 min. When the addition of the mixture of (3) and any remaining portion of components (a1), (a2), (a3) and (a5) and (a6) is made over a period of from 20 to 120 min, preferably over a period of from 30 to 90 min, remaining portion of components (a1), (a2), (a4), (a5) and (a6) is completed, polymerization is continued until and (a6) is complete, polymerization is continued until all the monomers employed have undergone essentially complete reaction.

The quantity and rate of addition of the initiator is [sic] preferably chosen such that a polyacrylate resin (A1) having a number-average molecular weight of from 1000 to 30,000 is obtained. It is preferred to commence the addition of initiator some time, in general about 15 minutes, before adding the monomers. A further preferred procedure is one in which the addition of initiator is commenced at the same time as the addition of the monomers and is terminated about half an hour after the addition of the monomers has been ended. The initiator is preferably added in a constant quantity per unit time. When the addition of initiator has ended, the reaction mixture is maintained at a temperature for a time (generally 14 h) polymerization temperature for a time (generally 14 h) 25

(A2), of polyesters which are obtainable by reaction of
Preference is given to the employment, as component

25

≤ 2.0 dPAs, preferably a viscosity of ≤ 1.0 dPAs.
ethoxyethyl propionate, have a viscosity at $23^\circ C$ of
employ polyesters which, as a 50% strength solution in
acid numbers and molecular figures. It is preferred to
20 (A2) are all polyesters having the stated OH numbers,
suitable hydroxyl- and carboxyl-containing polyesters

preferably from 80 to 60% by weight.
resin solutions formed have a solids content of
15 partially by distillation, so that the polyacrylate
70 to 50% by weight, and then the solvents are removed
preferably at a polymerization solution solids content of from
polymerization solids content which is not too high,
the monomers are preferably polymerized at a
10 For the preparation of the polyacrylate resins (A1),
possibility to remain unreacted.

weight, based on the weight of the reaction mixture,
residual monomer, of no more than up to about 0.5% by
5 that it is also possible for a small proportion of
weight of the monomers employed has been reacted, but
reaction" is intended to denote that preferably 100% by
essentially complete reaction. "Essentially complete
until all the monomers employed have undergone
reaction" to remain unreacted.

Examples of polycarboxylic acids which can be employed as component (p1) are aromatic, aliphatic and cyclic aliphatic polycarboxylic acids. As component (p1) it is preferred to employ aromatic and/or aliphatic polycarboxylic acids which can be employed as component (p1).

10 p₄) If desired, a component which is reactive with the
reaction product of (p₁), (p₂) and, if appro-
priate, (p₃).

(p3) If desired, further modifying components, and

5 p2) polyols, together if desired with monooles,

polycarboxylic acids or esterifiable derivatives, together if desired with monocarboxylic acids,

20

It is also possible, if desired, to employ together with the polycarboxylic acids monocarboxylic acids, examples being benzotic acid, tert-butylbenzoic acid, lauric acid, isophonanic acid and fatty acids of naturalily occurring oils. A preferred monocarboxylic acid is isonanonic acid.

actions, where they exist.

carboxylic acid, endothylenehexahydrophthalic acid, campboric acid, cyclohexanetetracarboxylic acid, cyclobutanetetracarboxylic acid, etc. The cycloaliphatic [basic] polycarboxylic acids can be employed both in the ⁵ two forms. Also suitable are the esterifiable derivatives of the above mentioned polycarboxylic acids, for example the mono- or polyvalent esters with aliphatic alcohols having 1 to 4 carbon atoms. Furthermore, it is also possible to employ the anhydrides of the above mentioned

of esterification, as described, for example, in
the polyesters (A2) are prepared by the known methods

25 is made to DE-A 40 24 204, page 4, lines 10 to 49.
least one tertiary amino group. For details, reference
tertiary amino group or mercapto compounds having at
for example monosocyanates having at least one
groups of the polyester (A2), a tertiary amino group,
to a group which is reactive toward the functional
(A2), suitable compounds are those having, in addition
as component (p4) for the preparation of the polyesters

DE-A-40 24 204 on page 4, lines 4 to 9.
15 of suitable components (p3) are described in
monosocyanates and/or monoepoxide compounds. Examples
and/or diepoxide compounds, and also, if desired,
component (p3) it is preferred to use polysocyanates
compounds specified as component (p4). As modifying
groups of the polyester, with the exception of the
have a group which is reactive toward the functional
preparation of the polyesters (A2) are compounds which
particularly suitable as component (p3) for the

5 propoxylated phenols.
butanol, octanol, lauryl alcohol, ethoxylated and/or
desirably which monohydrolic alcohols such as, for example,
polyethylene glycol, polypropylene glycol, together if
diacetoxymethyl, triethoxyethyl isocyanate,

reaction are all acid anhydrides which are customarily
described acid number. Suitable anhydrides for this
selected such that the resulting polyester has the
context, the quantity of carboxylic anhydrides is
anhydrides to give the desired polyester (A2). In this
which is then reacted in a second stage with carboxylic
number-average molecular weight of from 500 to 2000,
KOH/g, an acid number of less than 10 mg of KOH/g and a
polyester having an OH number of from 100 to 300 mg of
process by first of all preparing a hydroxyl-containing
(A2) polyesters which have been prepared by a two-stage
It is particularly preferred to employ as component
20
25

(cyclic) aliphatic hydrocarbons, for example cyclohexane.
hydrocarbons such as, in particular, xylenes, and
entrating agents which are employed are aromatic
suitable solvent as entraining agent. Examples of a
carried out in the presence of small quantities of a
10
15

like.
In this case the reaction is conveniently carried out
at temperatures of between 180 and 280°C, if desired in
the presence of a suitable esterification catalyst such
as, for example, lithium octoate, dibutyltin oxide,
dibutyltin dilaurate, para-toluene sulfoxide acid and the
5

suitable hydroxyl- and carboxyl-containing polyurethane

synthesized in the presence of the polyester.

25 same monomer composition as the polyacrylate resin polymers, in which, if desired, one resin has the a mixture of different polyacrylate resins and/or monomer composition. Furthermore, it is possible to add 20 containing polyacrylate resin having a different however, it is also possible to add a hydroxyl- resin synthesized in the presence of the polyester. have the same monomer composition as the polyacrylate it is possible for this already polymerized resin to subsequently added to the binder solution. In this case 15 any remaining quantity of component (A1) is component (A1) in the presence of component (A2). with particulate advantage, from 40 to 80% by weight of advantageous to prepare at least 20% by weight and, presence of the polyester (A2). In this case it is 10 (A1) to have been prepared at least partially in the it is possible, if desired, for the polyacrylate resin 5 anhydride.

aromatic polycarboxylic acids, such as trimellitic anhydrides and, in particulate, anhydrides [sic] of succinic anhydride and mixtures of these and/or other phthalic anhydride, tetrabhydrophthalic anhydride, trimellitic anhydride, pyromellitic [sic] anhydride, employed, for example hexahydrophthalic anhydride,

25 groups is between 2.0:1.0 and > 1.0:1.0, preferably with isocyanates. The ratio of equivalents of NCO to OH at 130°C, in organic solvents which are not able to react temperatures of up to 150°C, preferably from 50 to 200 mg of KOH/g, with excess polyisocyanate at 50 hydroxyl number of from 10 to 1800, preferably from 50 can be carried out by reaction of polyols having a The preparation of isocyanato-containing prepolymer

20

reactive toward isocyanate groups.

20 containing prepolymer with compounds which are containing which can be prepared by reacting isocyanato-resins which can be prepared by reacting isocyanato-

15 In component (I) it is preferred to employ polyurethane

15

10 EP-A-195 931, DE-A-33 21 180 and DE-A-40 05 961.

DE-A-36 28 124, EP-A-158 099, DE-A-29 26 584,

EP-A-89 497, US-A-4, 558, 090, US-A-4, 489, 135,

DE-A-26 24 442, DE-A-37 39 332, US-A-4, 719, 132,

DE-A-35 45 618, DE-A-38 13 866, DE-A-32 10 051,

in the following documents: EP-A-355 433,

Examples of suitable polyurethane resins are described

5 viscosity of <= 3.5 dPa.s.

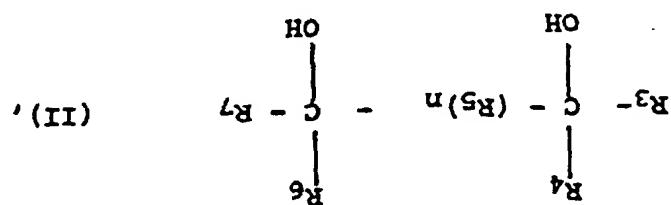
It is preferred to employ polyurethane resins which, as stated OH numbers, acid numbers and molecular figures. resins (A3) are all polyurethane resins having the

The polyols employed for the preparation of the prepolymer, may be of low molecular weight and may contain slow-to-react anionic groups or groups capable of forming anions. It is also possible to use low molecular weight polyols having a high molecular weight and may contain slow-to-react anionic groups. In this case, quantities of up to 30% by weight of the overall polyol components, preferably from about 2 to 20% by weight, are employed.

In order to obtain an NCO prepolymer of high weight, a linear polyol should be added, having a preferred OH functionality, a high proportion of a predominantly flexible, a high proportion of ether groups, because otherwise excessive quantities of ether groups, since otherwise the polymers formed swell in water. Polyether diols are prepared by esterification of organic diols, or are acids or anhydrides thereof with organic diols, or are derived from a hydroxycarboxylic acid or a lactone. In order to prepare branched polyesters it is necessary to employ to a minor extent polyols or polycarboxylic acids having a relatively high molecular weight to a maximum extent polyols or

5 10 15 20 25

20 alkyl radical of 1 to 6 carbon atoms, and in 15
carbon atoms, an aryl radical or an unsaturated
radical, and R₅ is an alkyl radical of 1 to 6
to 6 carbon atoms, a cycloalkyl radical or an aryl
different radicals and are an alkyl radical of 1
in which R₃, R₄, R₆ and R₇ are each identical or



15 a₂) at least one diol of the formula (II)

and/or R₂ may not be methyl, and/or
10 cycloaliphatic radical, with the proviso that R₁
18 carbon atoms, an aryl radical or a
different radical and are an alkyl radical of 1 to
in which R₁ and R₂ are each an identical or



10 a₁) at least one diol of the formula (I)

5 least to a certain proportion of
preparation of the polycarbonate resins consists at
preferably, the alcohol component employed for the

functionalities:

20 It is preferred to employ, as component (a1), 2-propyl-
 2-ethylpropane-1,3-diol, 2,2-diethylpropane-1,3-diol,
 2-buty-1-2-ethylpropane-1,3-diol and 2-phenyl-2-ethyl-
 propane-1,3-diol, 3-diol and component (a2),
 2,5-dimethylbutane-2,3-diol and 2,5-dimethylhexane-
 2,3-diethylbutane-2,3-diol and 2,5-dimethylhexane-
 2,5-diol. It is particularly preferred to employ, as
 component (a1), 2-buty-1-2-ethylpropane-1,3-diol and
 2-phenyl-2-ethylpropane-1,3-diol and, as component
 2-phenyl-2-ethylpropane-1,3-diol and, as component
 (a2), 2,5-dimethylhexane-2,5-diol.

15 As component (a2) it is possible to employ, for example, 2,5-dimethylhexane-2,5-diol, 2,5-dimethyl-, hexane-2,5-diol, 2-ethyl-5-methylhexane-2,5-diol, 2,4-dimethylpentane-2,4-diol, 2,3-dimethylbutane-2,3-diol, 1,4-(2-hydroxypropyl)benzene [sic] and 1,3-(2-hydroxypropyl)benzene [sic].

As component (a1), suitable propanediols of the formula
 (I) are all those in which either R1 or R2 or R1 and R2
 is not methyl, examples being 2-buty1-2-ethylpropane-
 1,3-diol, 2-phenyl-2-methylpropane-1,3-diol, 2-propyl-
 1,3-diol, 2-ethylpropane-1,3-diol, 2-di-tert-buty1propane-
 2-ethylpropane-1,3-diol, [sic], 2-buty1-2-propylpropane-1,3-diol,
 1-diethoxymethyl-bicyclo[2.2.1]heptane, 2,2-diethyl-
 propane-1,3-diol, 2,2-diproxy1propane-1,3-diol,
 2,2-diproxy1propane-1,3-diol, 2,2-diethyl-
 2-cyclohexyl-2-methylpropane-1,3-diol etcetera.

• १ २० ० अप्रैल

xylylene diisocyanate, bisphenolylene diisocyanate,
phenylene diisocyanate, toluylene diisocyanate,
Examples of polyisocyanates which can be employed are

25

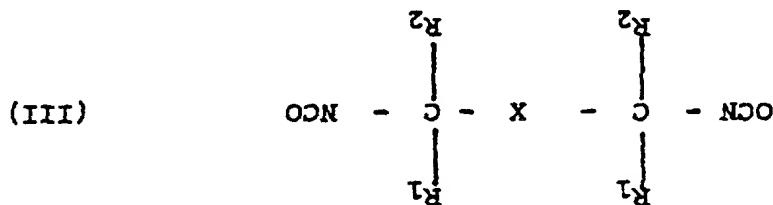
addition of monoisocyanates.

average functionality can be lowered, if desired, by
polyfunctional OH- or NH-containing compounds. The
diisocyanates or by reaction of diisocyanates which
20 formed by trimerization or oligomerization of
triisocyanates which have proven suitable are products
provided that this does not cause any gelting.
propagation of more highly functional polyisocyanates,
used to form the prepolymer may also contain a
15 tendency toward yellowing. The polyisocyanate component
diisocyanates give rise to products having a low
resistance to ultraviolet light, (cyclic)aliphatic
diisocyanates are preferred. Owing to their good
per molecule. The isomers or isomer mixtures of organic
10 polyisocyanates having at least two isocyanate groups
aliphatic, cycloaliphatic and/or aromatic
tion of the polyurethane resins, use is made of
A typical multifunctional isocyanates for the prepara-
tion of the polyurethane resins.

5 overall weight of the synthesis components employed for
from 1 to 7% by weight, based in each case on the
a quantity of from 0.5 to 15% by weight, preferably
Components (a1) and/or (a2) are customarily employed in
a

in which X is a divalent, aromatic hydrocarbon radical, preferably an optically halogen-, methyl- or methoxy- substituted napthylene, diphenylene or 1,2-, 1,3- or 1,4-phenylene radical, particularly preferably a 1,3-phenylene radical, and R_1 and R_2 are an alkyl radical of 1-4 carbon atoms, preferably a methyl radical. Disocyanates of the formula (III) are known radical. Their preparation is described, for example, in (cheir)

51



For the preparation of high-solids polyurethane resins, use is made in particular of diisocyanates solutions, such as made in particular of diisocyanates of the general formula (III)

10

Groups capable of forming anions are carboxyl, sulfonic groups and primary and/or secondary amino groups. 25 toward isocyanate groups are, in particular, hydroxyl forming anions. Suitable groups which are reactive groups and at least one group which is capable of least one group which is reactive toward isocyanate in water. Compounds used for this purpose contain at 20 polyurethane resin an acid number which is sufficient It is thus possible to incorporate into the

groups or carboxylic groups. 15 suitable groups of this kind are nonionic groups (eg. polyethers), anionic groups, mixtures of these two one group which ensures dispersibility in water. which are reactive with isocyanate groups, and at least to use compounds which contain two H-active groups preparation of the polyurethane resins, it is possible 10 constituents are incorporated and/or particular unless in the course of the synthesis specific polyurethanes are generally not compatible with water.

5 trade name TMXDI (META).
sold by the American Cyanamid [sic] Company under the (1,3-bis(2-isocyanatoprop-2-yl)benzene, for example, is US-A-4,439,616) and some obtainable commercially EP-A-101 832, US-A-3,290,350, US-A-4,130,577 and

25 The upper limit of the acid number is preferably at 40 mg of KOH/g, based on the solids content. The acid number is preferably within the range from 20 to 40 mg of KOH/g.

The quantity of ionizable carboxyl groups which is available in salt form owing to the neutralization of the carboxyl groups is generally at least 0.4% by weight, preferably at least 0.7% by weight, based on the solids content. The upper limit is about 12% by weight. The quantity of dihydroxyalkanolic acids in the weight. The neutralized prepolymer gives rise to an acid number of at least 5, preferably at least 10. In the case of unneutralized prepolymer gives rise to an acid number very low acid numbers, further measures are generally necessary in order to achieve dispersibility in water.

10
1. The empirical formula of alkanoic acids having two
acid and/or phosphonic acid groups. Preference is given
to the substituents on the carbon atom. The substituent may
be a hydroxyl group, an alkyl group or an alkylol
group. These polyois have at least one, generally from
1 to 3, carboxyl groups in the molecule. They have from
two to about 25, preferably from 3 to 10, carbon atoms.
The carboxyl groups-contained [sic] polyol may make up
from 3 to 100% by weight, preferably from 5 to 50% by
weight, of the overall polyol constituent in the NCO
prepolymer.

The isocyanate groups of the isocyanato-containing prepolymer are reacted with a modifying agent. In this context, the modifying agent is preferably added in a quantity such that chain extensions, and thus increases in molecular weight, occur. Preferred modifying agents are organic compounds containing hydroxyl and/or secondary and/or primary amino groups, in particular di-, tri- and/or more highly functional polyols. Examples of polyols which can be employed are trimethylolpropane, 1,3,4 butanetriol, glycerol, erythritol, mesoerythritol, arabitol, adonitol, etc. It is preferred to employ trimethylolpropane.

possible to react components (a), (b), (c) and (d) simultaneously. Examples of the preparation of the prepolymer are described in DE-A 26 24 442 and DE-A 32 10 051. In addition, however, it is also possible to prepare the polyurethane resins by reacting components (a), (b), (c), (d) and (e) simultaneously. The preparation of the polyurethane resins can be carried out by the known methods (e.g. acetone method).

possible to prepare the polyurethane resins by reacting components (a), (b), (c), (d) and (e) simultaneously. The preparation of the polyurethane resins can be carried out by the known methods (e.g. acetone method).

possible to react components (a), (b), (c) and (d) simultaneously. Examples of the preparation of the prepolymer are described in DE-A 26 24 442 and DE-A 32 10 051. In addition, however, it is also possible to prepare the polymer by reacting

Components (a), (b), (c) and (d) are preferably reacted, however, in ethoxyethyl propionate (EEP) as solvent. In this context, the quantity of ethoxyethyl propionate may vary within wide limits and should be sufficient to form a prepolymer solution of appropriate viscosity. In general up to 70% by weight, preferably less than 20% by weight of solvent is employed, based on the solids content. Thus the reaction can be carried out on the solids content. Thus the reaction can be carried out, if desired, in the presence of a catalyst, such as organotin compounds and/or tertiary amines. For the preparation of the prepolymer, the quantities of components (a), (b), (c) and (d) can be such that the ratio of equivalents of NCO to OH groups is between 2.0:1.0 and > 1.0:1.0, preferably between 1.4:1

25

20

15

and 1:1. The NCO prepolymer contains at least about 0.5% by weight of isocyanate groups, preferably at least 1% by weight of NCO, based on the solids content. The upper weight limit is at about 15% by weight, preferably 10% by weight, particularly preferably at 5% by weight of NCO.

suitable components (A4) are all water-dispersible binders which are compatible with the other constituents of component (I), being acrylicized polyurethane resins and/or polyester-acylates.

Component (I) preferably comprises as binder (A) at least 50% by weight, preferably at least 80% by weight, of at least one acrylate copolymer (A1),

(A2) from 0 to 30% by weight, preferably from 5 to 20% by weight, of at least one polyester (A2), and

(A3) from 0 to 30% by weight, preferably from 5 to 20% by weight, of at least one polyurethane resin by weight, of at least one further binder (A4),

25

(A3), and

(A4) from 0 to 10% by weight, preferably from 0 to 5% by weight, of at least one further binder (A4),

20

(A2) from 0 to 30% by weight, preferably from 5 to 20% by weight, of at least one polyester (A2), and

20

(A1) at least 50% by weight, preferably at least 80% by weight, of at least one acrylate copolymer (A1),

15

Component (I) preferably comprises as binder (A)

15

and 1:1. The NCO prepolymer contains at least about 0.5% by weight of isocyanate groups, preferably at least 1% by weight of NCO, based on the solids content. The upper weight limit is at about 15% by weight, particularly preferably at 5% by weight of NCO.

and 1:1. The NCO prepolymer contains at least about 0.5% by weight of isocyanate groups, preferably at least 1% by weight of NCO, based on the solids content. The upper weight limit is at about 15% by weight, particularly preferably at 5% by weight of NCO.

the sum of the proportions by weight of components (A1) to (A4) being in each case 100% by weight.

Component (I) can contain as constituent (B) all pigments which are customarily in aqueous coating compositions, in which do not react with water and/or do not dissolve in water, and the pigments which are customarily employed in conventional coating compositions. The pigments may consist of inorganic or organic compounds and may impart a special effect and/or color. The coating composition according to the invention therefore ensures, on the basis of this large number of suitable pigments, a universal spectrum of use of the coating compositions, such as commerical aluminum bronzes, flake pigments, such as commerical aluminum bronzes, and also nonmetallic effect pigments, for example DE-A-36 183, and commerical stainless-steel bronzes, aluminum bronzes chromatic in accordance with which also nonmetallic effect pigments are employed. These special-effect pigments which can be employed are metal

20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
105
110
115
120
125
130
135
140
145
150
155
160
165
170
175
180
185
190
195
200
205
210
215
220
225
230
235
240
245
250
255
260
265
270
275
280
285
290
295
300
305
310
315
320
325
330
335
340
345
350
355
360
365
370
375
380
385
390
395
400
405
410
415
420
425
430
435
440
445
450
455
460
465
470
475
480
485
490
495
500
505
510
515
520
525
530
535
540
545
550
555
560
565
570
575
580
585
590
595
600
605
610
615
620
625
630
635
640
645
650
655
660
665
670
675
680
685
690
695
700
705
710
715
720
725
730
735
740
745
750
755
760
765
770
775
780
785
790
795
800
805
810
815
820
825
830
835
840
845
850
855
860
865
870
875
880
885
890
895
900
905
910
915
920
925
930
935
940
945
950
955
960
965
970
975
980
985
990
995
1000
1005
1010
1015
1020
1025
1030
1035
1040
1045
1050
1055
1060
1065
1070
1075
1080
1085
1090
1095
1100
1105
1110
1115
1120
1125
1130
1135
1140
1145
1150
1155
1160
1165
1170
1175
1180
1185
1190
1195
1200
1205
1210
1215
1220
1225
1230
1235
1240
1245
1250
1255
1260
1265
1270
1275
1280
1285
1290
1295
1300
1305
1310
1315
1320
1325
1330
1335
1340
1345
1350
1355
1360
1365
1370
1375
1380
1385
1390
1395
1400
1405
1410
1415
1420
1425
1430
1435
1440
1445
1450
1455
1460
1465
1470
1475
1480
1485
1490
1495
1500
1505
1510
1515
1520
1525
1530
1535
1540
1545
1550
1555
1560
1565
1570
1575
1580
1585
1590
1595
1600
1605
1610
1615
1620
1625
1630
1635
1640
1645
1650
1655
1660
1665
1670
1675
1680
1685
1690
1695
1700
1705
1710
1715
1720
1725
1730
1735
1740
1745
1750
1755
1760
1765
1770
1775
1780
1785
1790
1795
1800
1805
1810
1815
1820
1825
1830
1835
1840
1845
1850
1855
1860
1865
1870
1875
1880
1885
1890
1895
1900
1905
1910
1915
1920
1925
1930
1935
1940
1945
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
2080
2085
2090
2095
2100
2105
2110
2115
2120
2125
2130
2135
2140
2145
2150
2155
2160
2165
2170
2175
2180
2185
2190
2195
2200
2205
2210
2215
2220
2225
2230
2235
2240
2245
2250
2255
2260
2265
2270
2275
2280
2285
2290
2295
2300
2305
2310
2315
2320
2325
2330
2335
2340
2345
2350
2355
2360
2365
2370
2375
2380
2385
2390
2395
2400
2405
2410
2415
2420
2425
2430
2435
2440
2445
2450
2455
2460
2465
2470
2475
2480
2485
2490
2495
2500
2505
2510
2515
2520
2525
2530
2535
2540
2545
2550
2555
2560
2565
2570
2575
2580
2585
2590
2595
2600
2605
2610
2615
2620
2625
2630
2635
2640
2645
2650
2655
2660
2665
2670
2675
2680
2685
2690
2695
2700
2705
2710
2715
2720
2725
2730
2735
2740
2745
2750
2755
2760
2765
2770
2775
2780
2785
2790
2795
2800
2805
2810
2815
2820
2825
2830
2835
2840
2845
2850
2855
2860
2865
2870
2875
2880
2885
2890
2895
2900
2905
2910
2915
2920
2925
2930
2935
2940
2945
2950
2955
2960
2965
2970
2975
2980
2985
2990
2995
3000
3005
3010
3015
3020
3025
3030
3035
3040
3045
3050
3055
3060
3065
3070
3075
3080
3085
3090
3095
3100
3105
3110
3115
3120
3125
3130
3135
3140
3145
3150
3155
3160
3165
3170
3175
3180
3185
3190
3195
3200
3205
3210
3215
3220
3225
3230
3235
3240
3245
3250
3255
3260
3265
3270
3275
3280
3285
3290
3295
3300
3305
3310
3315
3320
3325
3330
3335
3340
3345
3350
3355
3360
3365
3370
3375
3380
3385
3390
3395
3400
3405
3410
3415
3420
3425
3430
3435
3440
3445
3450
3455
3460
3465
3470
3475
3480
3485
3490
3495
3500
3505
3510
3515
3520
3525
3530
3535
3540
3545
3550
3555
3560
3565
3570
3575
3580
3585
3590
3595
3600
3605
3610
3615
3620
3625
3630
3635
3640
3645
3650
3655
3660
3665
3670
3675
3680
3685
3690
3695
3700
3705
3710
3715
3720
3725
3730
3735
3740
3745
3750
3755
3760
3765
3770
3775
3780
3785
3790
3795
3800
3805
3810
3815
3820
3825
3830
3835
3840
3845
3850
3855
3860
3865
3870
3875
3880
3885
3890
3895
3900
3905
3910
3915
3920
3925
3930
3935
3940
3945
3950
3955
3960
3965
3970
3975
3980
3985
3990
3995
4000
4005
4010
4015
4020
4025
4030
4035
4040
4045
4050
4055
4060
4065
4070
4075
4080
4085
4090
4095
4100
4105
4110
4115
4120
4125
4130
4135
4140
4145
4150
4155
4160
4165
4170
4175
4180
4185
4190
4195
4200
4205
4210
4215
4220
4225
4230
4235
4240
4245
4250
4255
4260
4265
4270
4275
4280
4285
4290
4295
4300
4305
4310
4315
4320
4325
4330
4335
4340
4345
4350
4355
4360
4365
4370
4375
4380
4385
4390
4395
4400
4405
4410
4415
4420
4425
4430
4435
4440
4445
4450
4455
4460
4465
4470
4475
4480
4485
4490
4495
4500
4505
4510
4515
4520
4525
4530
4535
4540
4545
4550
4555
4560
4565
4570
4575
4580
4585
4590
4595
4600
4605
4610
4615
4620
4625
4630
4635
4640
4645
4650
4655
4660
4665
4670
4675
4680
4685
4690
4695
4700
4705
4710
4715
4720
4725
4730
4735
4740
4745
4750
4755
4760
4765
4770
4775
4780
4785
4790
4795
4800
4805
4810
4815
4820
4825
4830
4835
4840
4845
4850
4855
4860
4865
4870
4875
4880
4885
4890
4895
4900
4905
4910
4915
4920
4925
4930
4935
4940
4945
4950
4955
4960
4965
4970
4975
4980
4985
4990
4995
5000
5005
5010
5015
5020
5025
5030
5035
5040
5045
5050
5055
5060
5065
5070
5075
5080
5085
5090
5095
5100
5105
5110
5115
5120
5125
5130
5135
5140
5145
5150
5155
5160
5165
5170
5175
5180
5185
5190
5195
5200
5205
5210
5215
5220
5225
5230
5235
5240
5245
5250
5255
5260
5265
5270
5275
5280
5285
5290
5295
5300
5305
5310
5315
5320
5325
5330
5335
5340
5345
5350
5355
5360
5365
5370
5375
5380
5385
5390
5395
5400
5405
5410
5415
5420
5425
5430
5435
5440
5445
5450
5455
5460
5465
5470
5475
5480
5485
5490
5495
5500
5505
5510
5515
5520
5525
5530
5535
5540
5545
5550
5555
5560
5565
5570
5575
5580
5585
5590
5595
5600
5605
5610
5615
5620
5625
5630
5635
5640
5645
5650
5655
5660
5665
5670
5675
5680
5685
5690
5695
5700
5705
5710
5715
5720
5725
5730
5735
5740
5745
5750
5755
5760
5765
5770
5775
5780
5785
5790
5795
5800
5805
5810
5815
5820
5825
5830
5835
5840
5845
5850
5855
5860
5865
5870
5875
5880
5885
5890
5895
5900
5905
5910
5915
5920
5925
5930
5935
5940
5945
5950
5955
5960
5965
5970
5975
5980
5985
5990
5995
6000
6005
6010
6015
6020
6025
6030
6035
6040
6045
6050
6055
6060
6065
6070
6075
6080
6085
6090
6095
6100
6105
6110
6115
6120
6125
6130
6135
6140
6145
6150
6155
6160
6165
6170
6175
6180
6185
6190
6195
6200
6205
6210
6215
6220
6225
6230
6235
6240
6245
6250
6255
6260
6265
6270
6275
6280
6285
6290
6295
6300
6305
6310
6315
6320
6325
6330
6335
6340
6345
6350
6355
6360
6365
6370
6375
6380
6385
6390
6395
6400
6405
6410
6415
6420
6425
6430
6435
6440
6445
6450
6455
6460
6465
6470
6475
6480
6485
6490
6495
6500
6505
6510
6515
6520
6525
6530
6535
6540
6545
6550
6555
6560
6565
6570
6575
6580
6585
6590
6595
6600
6605
6610
6615
6620
6625
6630
6635
6640
6645
6650
6655
6660
6665
6670
6675
6680
6685
6690
6695
6700
6705
6710
6715
6720
6725
6730
6735
6740
6745
6750
6755
6760
6765
6770
6775
6780
6785
6790
6795
6800
6805
6810
6815
6820
6825
6830
6835
6840
6845
6850
6855
6860
6865
6870
6875
6880
6885
6890
6895
6900
6905
6910
6915
6920
6925
6930
6935
6940
6945
6950
6955
6960
6965
6970
6975
6980
6985
6990
6995
7000
7005
7010
7015
7020
7025
7030
7035
7040
7045
7050
7055
7060
7065
7070
7075
7080
7085
7090
7095
7100
7105
7110
7115
7120
7125
7130
7135
7140
7145
7150
7155
7160
7165
7170
7175
7180
7185
7190
7195
7200
7205
7210
7215
7220
7225
7230
7235
7240
7245
7250
7255
7260
7265
7270
7275
7280
7285
7290
7295
7300
7305
7310
7315
7320
7325
7330
7335
7340
7345
7350
7355
7360
7365
7370
7375
7380
7385
7390
7395
7400
7405
7410
7415
7420
7425
7430
7435
7440
7445
7450
7455
7460
7465
7470
7475
7480
7485
7490
7495
7500
7505
7510
7515
7520
7525
7530
7535
7540
7545
7550
7555
7560
7565
7570
7575
7580
7585
7590
7595
7600
7605
7610
7615
7620
7625
7630
7635
7640
7645
7650
7655
7660
7665
7670
7675
7680
7685
7690
7695
7700
7705
7710
7715
7720
7725
7730
7735
7740
7745
7750
7755
7760
7765
7770
7775
7780
7785
7790
7795
7800
7805
7810
7815
7820
7825
7830
7835
7840
7845
7850
7855
7860
7865
7870
7875
7880
7885
7890
7895
7900
7905
7910
7915
7920
7925
7930
7935
7940
7945
7950
7955
7960
7965
7970
7975
7980
7985
7990
7995
8000
8005
8010
8015
8020
8025
8030
8035
8040
8045
8050
8055
8060
8065
8070
8075
8080
8085
8090
8095
8100
8105
8110
8115
8120
8125
8130
8135
8140
8145
8150
8155
8160
8165
8170
8175
8180
8185
8190
8195
8200
8205
8210
8215
8220
8225
8230
8235
8240
8245
8250
8255
8260
8265
8270
8275
8280
8285
8290
8295
8300
8305
8310
8315
8320
8325
8330
8335
8340
8345
8350
8355
8360
8365
8370
8375
8380
8385
8390
8395
8400
8405
8410
8415
8420
8425
8430
8435
8440
8445
8450
8455
8460
8465
8470
8475
8480
8485
8490
8495
8500
8505
8510
8515
8520
8525
8530
8535
8540
8545
8550
8555
8560
8565
8570
8575
8580
8585
8590
8595
8600
8605
8610
8615
8620
8625
8630
8635
8640
8645
8650
8655
8660
8665
8670
8675
8680
8685
8690
8695
8700
8705
8710
8715
8720
8725
8730
8735
8740
8745
8750
8755
8760
8765
8770
8775
8780
8785
8790
8795
8800
8805
8810
8815
8820
8825
8830
8835
8840
8845
8850
8855
8860
8865
8870
8875
8880
8885
8890
8895
8900
8905
8910
8915
8920
8925
8930
8935
8940
8945
8950
8955
8960
8965
8970
8975
8980
8985
8990
8995
9000
9005
9010
9015
9020
9025
9030
9035
9040
9045
9050
9055
9060
9065
9070
9075
9080
9085
9090
9095
9100
9105
9110
9115
9120
9125
9130
9135
9140
9145
9150
9155
9160
9165
9170
9175
9180
9185
9190
9195
9200
9205
9210
9215
9220
9225
9230
9235
9240
9245
9250
9255
9260
9265
9270
9275
9280
9285
9290
9295
9300
9305
9310
9315
9320
9325
9330
9335
9340
9345
9350
9355
9360
9365
9370
9375
9380
9385
9390
9395
9400
9405
9410
9415
9420
9425

Red, Irgazine Orange and Helioquin Green.

25 The quantity of neutralizing agent employed overall in the coating composition according to the invention is selected such that from 1 to 100 equivalents, preferably from 50 to 90 equivalents, of the carboxyl groups of the binder (A) are neutralized.

to be present exclusively in the coating component
25 to control the additive, for the inorganic polyisostyrene-
it is particularly preferred, in cases in which an
inorganic polyisostyrene is employed as rheology-
control additive, it is preferred, in cases in which an
It is particularly preferred, in cases in which an

polyisostyrenes. — — — — —
rheology-control additives to employ inorganic
urethanes or polyacrylates. It is preferred as
thermoplastic hydrophobicity modified, ethoxylated
ethylene-maleic anhydride copolymers and derivatives
polyvinylpyrrolidone, styrene-maleic anhydride or
poly(methyl acrylate), poly(methyl acrylate) acid,
groups, such as polyvinyl alcohol,
benzethonium polymers having ionic and/or associative
polyisostyrenes of the montmorillonite type, and
polyisobutylene and sodium-magnesium-fluorite-lithium
aluminum-magnesium, stannates, sodium-magnesium
EP-A-38 127, inorganic polyisostyrenes, for example
polymeric microparticulates, as disclosed for example in
rheology-control additives, are: crosslinked
one rheology-control additive. Examples of
As constituent (E) component (I) may contain at least
10

component (I) and/or (III).
preferably, however, the neutralizing agent is added to
component (I) and/or (II) and/or (III) and/or (IV).
In this context, the neutralizing agent can be added to
5

(E) from 0 to 20% by weight, preferably from 2 to 10%

by weight, of at least one neutralizing agent,
25 (D) from 0 to 20% by weight, preferably from 2 to 10%

dilutable solvent, and
by weight, of at least one organic, water-
(C) from 5 to 50% by weight, preferably from 10 to 40%

20 by weight, of at least one pigment and/or filler,
(B) from 0 to 60% by weight, preferably from 5 to 50%

80% by weight, of the binder (A),
15 (A) from 20 to 90% by weight, preferably from 35 to

10 components (I) which comprise
according to the invention, it is preferred to employ
for the preparation of the coating compositions
for the preparation of the coating compositions

referred to as component (IV).
5 It is of course also possible for the additives
mentioned to be added separately to the coating
composition. In this case the additives are then
referred to as component (IV).

Further, component (I) may contain at least one
further conventional coatings additive. Examples of
such additives are antifoams, dispersing aids,
emulsifiers, and leveling auxiliaries.

reduce the viscosity of the polyisocyanate to a value
in proportion of the isocyanate and, if desired, to
polyisocyanates, in order thus to improve the ease of
25 based on pure polyisocyanate, may also be added to the
organic solvent, preferably from 1 to 25% by weight,
to 2000 MPa (at 23°C). If desired, small quantities of
groups per molecule and having viscosity quantities of from 100
emulsifying polyisocyanates having 2 to 5 isocyanate
20 and/or aromatic moieties. Preference is given to
attached to aliphatic, cycloaliphatic, araliphatic
organic polyisocyanates having free isocyanate groups
The polyisocyanate component (F1) may be any desired
25

resin (F3).
15
epoxide groups per molecule and/or at least one amino
least one epoxide compound (F2) having at least two
least one further crosslinking agent selected from at
least one organic, water-dilutable solvents, and, if desired, at
10 one nonpolar di- and/or polyisocyanate (F1) which is,
component (II). Compares as crosslinking agent at least
IC is essential to the invention that the coating
15 to (E) being in each case 100% by weight.

5 The sum of the proportions by weight of components (A)

and/or additive,
by weight, of at least one conventional auxiliary

Within the above mentioned ranges. Examples of solvents suitable as additives for the polyisobutylenes are ethoxyethyl propionate, butyl acetate and the like. Examples of suitable isocyanates are methods example, in "Methoden der organischen Chemie" [Methods of organic Chemistry], Houben-Weyl, Volume 24/2, 4th edition, George Thieme Verlag, Stuttgart 1963, page 61 to 70, and by W. Stiefen, Liebig Ann. Chem. 562, 75 to 136. Suitable examples are the isocyanates mentioned in the context of the description of the polyurethane resins (A3). .

Examples of suitable isocyanates are described, for example, in "Methoden der organisch-chemischen Chemie" [Methods of organic chemistry], Houben-Weyl, Volume 14/2, 4th Edition, George Thieme Verlag, Stuttgart 1963, page 61 to 70, and by W. Stieffken, Liebigs Ann. Chem. 562, 75 to 136. Suitable examples are the isocyanates mentioned in the context of the description of the polyurethane resins (A3). 10

It is also possible to employ polyisocyanates which contain isocyanurate groups and/or biuret groups and/or aliphatic isocyanate groups and/or urethane groups and/or urea groups. Polyisocyanates containing urethane groups are obtained, for example, by reacting some of the isocyanate groups with polyols, for example, for example and glycerol.

It is preferred to employ aliphatic or cycloaliphatic polyisocyanates, especially hexamethylene diisocyanate, diimerized and trimerized hexamethylene diisocyanate, isophorone diisocyanate, diisocyanate or dicyclohexylmethane diisocyanate, 2,4'-diisocyanate or dicyclohexylmethane 4,4'-diiso-25 cyanate or mixtures of these polyisocyanates. Very particular preference is given to the use of mixtures

(polyglycerol polyglycidyl ether).
(polyglycerol polyglycidyl ether) and Denacol EX-521
(trimethylolpropane polyglycidyl ether), Denacol EX-512
25 (pentamethyltriethyl polyglycidyl ether), Denacol EX-321
Chemicals Ltd., Japan, for example Denacol EX-411
names Epikote[®] from Shell or Denacol from Nagase
epoxides which are obtainable commercially under the
suitable examples of component (F2) include the poly-

20

bisphenol F.

epoxides, based for example on bisphenol A or
aliphatic and/or cycloaliphatic and/or aromatic poly-
Examples of suitable polyepoxides (F2) are all known

15

crosslinking agent (F).

100% by weight, based on the overall weight of the
particularly preferably in a quantity of from 80 to
taguously in a quantity of at least 70% by weight,
coating compositions according to the invention advan-
The polyisocyanate component (F1) is employed in the
10

of the polyisocyanates specified by way of example.
may otherwise also be composed of any desired mixtures
suitable catalysts. The polyisocyanate component (B)
oligomerization of hexamethylene diisocyanate using
hexamethylene diisocyanate, as are formed by catalytic
isocyanurate groups and/or allophanate groups, based on
of polyisocyanates, containing urethane and/or

5

(F) from 50 to 100% by weight, preferably from 60 to

(II) which comprise

25 to the invention, it is preferred to employ components
In order to prepare the coating compositions according

component (I).

20 Constituents (G) and (H) of coating component (II)
correspond to constituents (C) and (E) of coating

(F).

based on the overall weight of the crosslinking agent
preferably in a quantity of from 2 to 20% by weight,
15 in a quantity of from 0 to 30% by weight, particularly
compositions according to the invention advantageously
The amino resin (F3) is employed in the coating

Cyanamide and Iuwtapal® LR 8839 from BASF AG.

10 able commercially under the name Cyanel® 325 from
functional melamine resins such as the products obtain-
example of suitable amino resins (F3) are imino-

crosslinking agent (F).

5 by weight, based on the overall weight of the
particularly preferably in a quantity of from 2 to 20%
employed in a quantity of from 0 to 30% by weight,
the polyepoxide component (F2) is advantageously
In the coating compositions according to the invention,

by weight, of at least one neutralizing agent, and

(J) from 0 to 20% by weight, preferably from 2 to 10%

25

95% by weight, of water,

(I) from 80 to 100% by weight, preferably from 80 to

(III) which comprise

20 to the invention, it is preferred to employ components

In order to prepare the coating compositions according

component (I).

15 Constituents (J) and (K) of coating component (III)

to (H) being in each case 100% by weight.

The sum of the proportions by weight of components (F)

10 and/or additive,

by weight, of at least one conventional auxiliary

(H) from 0 to 20% by weight, preferably from 0 to 10%

5 solvent, and

by weight, of at least one organic, water-miscible

(G) from 0 to 50% by weight, preferably from 10 to 40%

(F),

90% by weight, of at least one crosslinking agent

25 weight, preferably from 30 to 60% by weight, of binder,
from 10 to 20% by weight, of water, from 25 to 70% by
organic solvents, from 5 to 25% by weight, preferably,
coatings additives of from 0 to 10% by weight, of
preferably have an overall content of conventional
coating compositions according to the invention
preferably between 1:1.2 and 1:1.5. Furthermore, the
crosslinking agent (F) is between 1:2 and 2:1,
binder (A) to the crosslinking groups of the
ratio of equivalents of hydroxyl groups of the
(II) are preferably employed in quantities such that
to prepare the coating compositions, components (I) and
20

25 the coating composition.
the quantity of the auxiliaries and additives employed in
(IV) which are composed of a portion or of the entire
to the invention, it is preferred to employ components
in order to prepare the coating compositions according
10

to (I) being in each case 100% by weight.
the sum of the proportions by weight of components (I)

5 (I) from 0 to 20% by weight, preferably from 0 to 10%
by weight, of at least one emulsion polymer,
(k) from 0 to 20% by weight, preferably from 2 to 10%
by weight, of at least one conventional auxiliary
and/or additive,

dispersing the individual constituents.
the person skilled in the art, by mixing and/or
likewise prepared by methods which are well-known to
25 components (II), (III) and, if appropriate, (IV) are

20 dissociative.
of further organic solvents, by means of a stirrer or
above-described binders, if desired with the addition
is then stirred into a mixture of one or more of the
effect pigments with one or more solvents. This mixture
incorporated by homogeneous mixing of the special-
The special-effect pigments are customarily

15 apparatus, for example bead mills and sand mills.
dispersion is carried out with the aid of customary
respective pigments in one or more binders. Pigment
is conveniently carried out by dispersing the
example, the incorporation of color-imparting pigments
10 dispersing the individual constituents. Thus, for
person skilled in the art, by mixing and, if desired,
component (I) is prepared by methods known to the

5 overall weight of the coating composition.
from 0 to 30% by weight, based in each case on the
and/or fillers, from 0 to 50% by weight, preferably
preferably from 10 to 20% by weight; and of pigments
weight; of crosslinking agent, from 5 to 30% by weight,
from 15 to 50% by weight, preferably from 20 to 40% by

25
Furthermore, the coating composition according to the
invention can be prepared, for example, in analogy to
the procedure just described, but with the neutralizing
agent not being present in component (III) but instead
being added separately prior to the addition of
component (III).

20
Then to add component (III), containing neutralizing
coating composition obtained. An alternative option is
(III) containing neutralizing agent and to disperse the
then to add the mixture thus obtained to component
component (IV) is added to this mixture. One option is
containing no neutralizing agent. Then, if desired,
base these components (I) and (II) preferably
first of all to mix components (I) and (II), in this
the coating compositions according to the invention,
thus, for example, it is possible, in order to prepare
10

5
The coating compositions.
dispersed not until shortly before the application of
coating compositions components (I), (II), (III) and,
if "appropriate", (IV) are mixed and, if desired,
invention that in the course of the preparation of the
in this context, however, it is essential to the
components (I), (II), (III) and, if appropriate, (IV).
be prepared by all conceivable mixing methods from
the coating compositions according to the invention can

component (III).
when incorporating this mixture by dispersion into
component (II) and, if desired, component (IV), and
neutralizing agent has already been added, with
preferably prepared by mixing component (I), to which
the coating compositions according to the invention are

20 components (II) and, if desired, (IV) are added.
(III) and homogenized by dispersion, and then com-
(ii) mixed with component (III) or added to component

15. may in each case is, in addition, homogenized by
it, and the coating composition obtained in this
component (III) or has component (III) added to
mixture thus obtained is then either added to
mixture with (II) and, if appropriate, (IV)), the
component (IV) (simultaneously, or successive
(i) mixed with component (II) and, if desired,
dispersion, or

20 may is then either
neutralizing agent. The component (I) obtained in this
employ a component (I) which already contains the
is possible instead of this mixing operation also to
the neutralizing agent to component (I). Of course, it
invention can also be prepared by first of all adding
Moreover, the coating composition according to the
90286

centages therein are by weight unless expressly stated
the basis of exemplary embodiments. All parts and per-
the invention will now be illustrated in more detail on

25

preferably employed, however, as clearcoats.
coating compositions according to the invention are
multilayer coating (basecoat/clearcoat method). The
clearcoats in a process for the production of a
one-layer topcoats, and as pigmented basecoats or as
invention can be employed as fillers and for producing
The aqueous coating compositions according to the
20

are preferably employed in the area of refinishing.
the refinishing of motor-vehicle bodies. However, they
employed both in the production-line finishing and in
coating compositions according to the invention may be
preferably employed for the production of topcoats. The
coating compositions according to the invention are
15

10

preferably at temperatures of not more than 80°C.
customarily cured at temperatures below 120°C,
The coating compositions according to the invention are
5

plastic or paper.
to any desired substrates, for example metal, wood,
example spraying, knife coating, brushing or dipping,
be applied by conventional application methods, for
The coating compositions according to the invention can

Examples 1 to 14 and Comparative Examples 1 and 2

otherwise.

5 1. Preparation of a water-dispersible acrylate resin

(A1) employed in accordance with the invention

74 parts by weight of isopropoxypropanol are introduced

10 into a steel vessel fitted with monomer feed, initiator feed, thermometer, oil heating and reflux condenser, and are heated to 120°C. A solution of 8.0 parts by weight of t-butyll perethoxyethoxypropionate in 6.0 parts by weight of t-butyll perethoxyethoxypropionate is then added at a rate such that the addition is concluded after 45 min. The commencement of the addition of the t-butyll perethoxyethoxypropionate is accompanied by the beginning of the addition of the monomer mixture of

15 (A1), (A2), (A3) and (A6)

20 (a1) : 18.5 parts of n-butyll methacrylate

12.4 parts of methyl methacrylate,

10.0 parts of lauryll acrylate

(commercial product Methacrylate 13 from Rhône

25 [säc] AG, Darmstadt)

10.0 parts of cyclohexyl methacrylate

(a6) : 15.0 parts by weight of styrene

25 The preparation of the acrylate resin (VA1) is carried out in analogy to the preparation of the acrylate resin (A1). In contrast to the preparation of the acrylate resin (A1), however, adjustment of the solid content to 80% is followed by addition at 90°C first of all of dimethyltetrahydrofuran (degree of neutralization: 85%)

20 2. Preparation of an aqueous dispersion of the acrylate resin (VA1)

15 The viscosity of a 50% strength solution of the acrylate resin in ethoxyethoxy propionate is 2.9 dPAs. of 2800 and a weight-average molecular weight of 8700. KOH/g of solid resin, a number-average molecular weight of KOH/g of solid resin, an acid number of 40 mg of acrylate resin thus obtained has an OH number of 140 mg organic solvent, to a solids content of 80%. The mixture is adjusted, by distillation removal of the

10 mixture at 120°C for a further 2 h. The reaction maintained at 120°C for the t-butyl perethoxyhexanoate when the addition of the t-butyl perethoxyhexanoate solution is complete, the reaction mixture is rate such that the addition is concluded after 4 hours.

5 The mixture (a1), (a2), (a3) and (a6) is added at a (a3): 5.1 parts by weight of acrylic acid.

(a2): 29.0 parts by weight of hydroxyethyl acrylate

employed in accordance with the invention
3. Preparation of a water-dispersible polyester (A2)
5
and then by addition of water to set a solids content
of 40%. The organic solvent is removed by means of
distillation under vacuum down to $\leq 3\%$. Taring water, a
final solids content of 40% is set.
10 parts of neopentyl hydroxypropylate, 6.658 parts of
trimethylolpropane and 26.775 parts of
hexahydrophthalic anhydride are heated at 230°C in a
reactor equipped with oil thermostat and stirrer. The
neutralizing agent used is cyclohexane. After an acid
15 number of ≤ 5 mg of KOH/g of solids has been reacted,
the mixture is cooled to 150°C and 14.296 parts of
trimellitic anhydride are added. The mixture is then
heated to 190°C and esterification is carried out at
this temperature until an acid number of 30 mg of KOH/g
20 of solid resin has been reacted. The polyester resin is
diluted with isopropoxypropanol to a solids content of
number of 130 mg of KOH/g of solid resin and a number
80%. The polyester obtained in this way has an OH
value of 50% strength solution of the polyester in ethoxyethyl
25 average molecular weight of 3800. The viscosity of a
average molecular weight of 1500 and also a weight-
number of 130 mg of KOH/g of solid resin and a number
of 130 mg of KOH/g of solid resin is 0.8 dpa.s (23°C).

20 In an apparatus conventional for polyester synthesis, 371.2 g of Propol 1013 (commercial diimetic fatty acid having a monomer content of not more than 0.1%, a triester content of not more than 2%, an acid number of 198-202 mg of KOH/g), 107.7 g of cyclohexanediethanol, 723.3 g of neopenetyl glycol hydrroxypivalate, 17.2 g of ethylbutylpropenediol, 392.6 g of neopenetyl glycol and 1018.7 g of isophthalic acid were reacted, with cyclohexane as entraining agent and 0.25 g of monobutyltin oxide hydrate, to an acid number < 5.0. The cyclohexane was removed by distillation and the polyester run up to an acid number of < 1.5. The batch was cooled to about 100°C and partially dissolved to 79.5% with ethoxyethyl propionate. The polyester diol is has an Mn of 2352 (measured by GPC against polystyrene standard) and a glass transition temperature (measured by DSC) of -16°C. The viscosity of a 60% strength solution in ethoxyethyl propionate [sic] at 23°C is

4.1. Preparation of a polyester diol B

4. Preparation of a polyurethane resin (A3) employed in accordance with the invention

In a 5 l reaction vessel with stirrer and reflux condenser, a mixture of 728.9 g of the polyester 47.9 g of dimethylolpropionic acid and 241.9 g of tetramethylxylylene diisocyanate was heated at a reaction temperature of 115°C until the mixture had reacted a constant NCO value. Subsequently, 2.2 times the molar quantity of trimethylolpropane was added per mole of diisocyanate, and the mixture was reacted until the isocyanate content was virtually zero. The mixture was partially dissolved with 500 g of butoxypropanol, and 23.9 g of dimethylacetamide were added in one portion at a temperature of 100°C. Finally, a solids content of 60% was set with butoxypropanol. The binder has an OH number of 60 mg of KOH/g and an acid number of 20.6 mg of KOH/g, and also a viscosity (10:3 in N-methylpyrrolidone) of 13.5 dPAs. The number-average molecular weight is 4500, the weight-average molecular weight is 19,500. The viscosity of a 50% strength solution of the polyurethane in ethoxyethyl propionate is 4.1 dPAs (23°C).

4.2. Preparation of the polyurethane resin (A3)

25 The preparation of the coating compositions of Examples 1 to 5 was carried out by mixing the components 1 to 5 indicated in Table 4 using a stirrer (600 revolutions per minute), by adding a mixture of components (I) and

5.4. Preparation of the coating compositions

Component (III) is prepared by mixing the constituents indicated in Table 3 using a stirrer (600 revolutions per minute).

5.3. Preparation of component (III)

component (II) is prepared by mixing the constituents indicated in Table 2 using a stirrer (600 revolutions per minute).

5.2. Preparation of component (II)

component (I) is prepared by mixing the constituents indicated in Table I using a stirrer (600 revolutions per minute).

5.1. Preparation of component (i)

5. Preparation of the coating compositions of Examples 1 to 14 and of the coating compositions of Comparative Examples VI

25 The preparation of the coating compositions of Examples
11 to 14 was carried out by mixing the components indicated
in Table 5 using a stirrer (600 revolutions per
minute), by premixing components (I) and (II) and then
stirring this preliminary mixture into component (III).
20

20 The preparation of the coating compositions of Examples
10 was carried out by mixing the components indicated
in Table 4 using a stirrer (600 revolutions per
minute), by taking component (III) as initial charge
and then incorporating component (I) and, subsequently,
component (II), in both cases by stirring.
15

15 The preparation of the coating compositions of Examples
7 to 9 was carried out in analogy to the preparation of
the coating compositions of Examples 2, 3 and 6, but
with the difference that the components indicated in
Table 4 were mixed by hand, i.e. without the use of a
stirrer.

5 The preparation of the coating compositions of Examples
6 was carried out by mixing the components indicated in
Table 4 using a stirrer (600 revolutions per minute),
by first of all premixing components (I) and (II) and
then adding component (III) to this mixture.

(II) to component (III).

65 parts by weight of a commerical polypropylene
glycol having an average molecular
weight of 400 and an OH number of

25

constituents:

A component 1 was prepared by mixing the following

6.2. Preparation of a component 1

20

In analogy to Example 2 of EP-A-368 499, 0.5 part by
weight of *p*-toluenesulfonic acid was dissolved in 99.5
parts by weight of deionized water.

6.1. Preparation of a coating dilution

In accordance with the teaching of EP-A-368 499 and
based on Examples 2, 7, 8, 13 and 14 of EP-A-368 499,
the following examples were carried out in imitation:

10

Five Example V2

6. Preparation of the coating composition of compara-

The preparation of the coating composition of compara-
tive Example 1 was carried out in analogy to the
preparation of the coating composition of Example 1,
with the difference that the acrylate resin (VA1) was
employed instead of the acrylate resin (A1) and that no
component (III) was added.

5

hyde resin (commercial product
35 parts by weight of a commercial melamine-formaldehyde-
and a theoretical OH number of 748
25 theoretical molecular weight of 150
65 parts by weight of triethylene glycol having a

20
6.3. Preparation of a component 2
A component 2 was prepared from the following constituents:
25
20

10
in this mixture with stirring.
15 mixture. The surface-active agent was then incorporated
resin and the isopropanol, with stirring, to give a
the polypropylene glycol, the melamine-formaldehyde
column 6, lines 45 to 50, by first of all processing
process described in the description of EP-A-368 499 in
In addition, component 1 was also prepared by the
10

20 parts by weight of isopropanol
Byk 341 from Byk)
agent (commercial product additive
0.5 part by weight of a commercial surface-active
Cymel 303 from Cynamid)
hyde resin (commercial product
35 parts by weight of a commercial melamine-formaldehyde-
duct PPG-400 from Union Carbide)
~ 140 mg of KOH/g (commercial pro-

25 A water-dilutable basecoat composition pigmented with
electrodeposition coating and a commercial filler, so
to a phosphatized steel panel coated with a commercial
aluminum flakes, according to EP-A-279 813, is applied
and testing of the baked coating films

7.) Application of the transparent topcoat compositions
and homogeneous.

20 Since the para-toluene sulfonic acid solution
flocculated out and the mixture obtained was highly
however, it was not possible to produce clearcoats,
dilution.

15 140.5 parts by weight of component 2 were mixed, with
140.5 parts by weight of component 1 or, respectively,
140.5 parts by weight of component 1, by weight of the coating
stirring, with 100 parts by weight of the coating

10 6.4. Preparation of the coating compositions 1 and 2

of component 1, by the 2 methods described herein.
Component 2 was prepared in analogy to the preparation

5 20 parts by weight of isopropanol
Byk 341 (from Byk)
agent (commercial product additive
0.5 part by weight of a commercial: surface-active
Cymel 303 (from Cyanamid)

as to give a dry film thickness of from 12 to 15 μ . The applied basecoat composition is dried for 10 min at 60°C. A topcoat 500m temperature and for 10 min at 60°C. A topcoat composition, obtained as in section 6 is then sprayed onto the basecoat in 3 spray passes with a flashoff time of 15 min in between. The panel is finally dried for 60 min at 200m temperature and baked for 30 min at 60°C in a circulating-air oven. The multilayer coating thus obtained were subjected to a number of tests. The best results are shown in Tables 6 and 7.

Table 1: Composition of component (I)

Example	1	2	3	4	5	6	7	8	9	10	V1
A1 (SC: 75%) 1)	25	25	30	30	30	30	25	30	30	30	-
A2 (SC: 85%) 1)	-	5	-	-	-	-	5	-	-	-	-
A3 (SC: 50%) 1)	8	-	-	-	-	-	-	-	-	-	-
VAl (SC: 39%) 1)	-	-	-	-	-	-	-	-	-	-	63.0
DMEA 2)	-	-	1.3	-	-	-	-	-	1.3	-	1.3
Proglyde DMM ³)	6.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	4.0
Byk 3314)	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Tegoflow 425 ⁵)	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Σ	39.1	37.1	38.4	37.1	37.1	37.1	37.1	37.1	38.4	37.1	68.4

- 1) Acrylate resin solution or acrylate dispersion
- 2) Dimethylethanolamine
- 3) Commercial dipropylene glycol dimethyl ether from Dow Chemical Company
- 4) Leveling additive based on a polyether-modified dimethylpolysiloxane copolymer from Byk
- 5) Commercial additive based on a polysiloxane-polyether copolymer from Goldschmidt

Table 2: Composition of component (II)

Example	1	2	3	4	5	6	7	8	9	10	V1
Desmodur VPLS-2102 ¹⁾	7.8	7.8	7.8	-	3.9	7.8	7.8	7.8	7.8	7.8	15.4
(Bayer AG)											
Tolonate HDTLV ²⁾	6.9	6.9	6.9	13.8	10.4	6.9	6.9	6.9	6.9	6.9	-
(Rhône Poulenc)											
Proglyde DMM ³⁾	1.6	1.6	1.6	2.5	2.0	1.6	1.6	1.6	1.6	1.6	3.8
Σ	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	19.2

1) Commercial isocyanate based on a hexamethylene diisocyanate allophanate from Bayer AG

2) Commercial isocyanate based on a hexamethylene diisocyanate trimer of low viscosity, from Rhône-Poulenc

3) Commercial dipropylene glycol dimethyl ether from Dow Chemical Company

Table 3: Composition of component (III)

Example	1	2	3	4	5	6	7	8	9	10	V1
Water	41.6	43.6	43.6	43.6	43.6	43.6	43.6	43.6	43.6	43.6	10.7
DMEA 1)	1.3	1.3	-	1.3	1.3	1.3	1.3	1.3	1.3	-	-
Dapral T210 ²⁾ (10% strength)	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
Σ	44.6	46.6	45.3	46.6	46.6	46.6	46.6	46.6	45.3	46.6	12.4

1) Dimethyllethanolamine

2) Commercial, nonionic polyurethane thickener (10% strength in water) from Akzo

Table 4: Composition of the coating compositions

Component	1	2	3	4	5	6	7	8	9	10	V1
I	39.1	37.1	38.4	37.1	37.1	37.1	37.1	38.4	37.1	68.4	
II	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	19.2	
III	44.6	46.6	45.3	46.6	46.6	46.6	46.6	45.3	46.6	12.4	

3) Commercial leveling additive based on a polyether-

10

[sic] and Haas

2) Acyl-alkyl polyethylene ether alcohol from Rhom

1) Commercial dipropylene glycol dimethyl ether from Dow Chemical Company

5

Example	11	12	13	14	(10% strength)		
Binder A1	28.0	28.2	28.0	28.2	Proglyde DMM ₁)	5.4	5.4
Methyl isobutyl ketone	0.5	0.5	0.5	0.5	Trition X 100 ₂)	0.5	0.5
Butyl diglycol acetate	0.5	0.5	0.7	0.7	BYK 331 ₃)	0.05	0.05
Butyl glycol	0.5	0.5	-	-	Tegoflow 4254 ₄)	0.05	0.05
Dessmodur VPIs 2102 ₅)	14.2	7.2	14.2	7.2	Tolonate HDT IV ₆)	-	6.8
Proglyde DMM ₁)	3.7	3.7	3.7	3.7	Water (deter.)	43.8	43.8
III - DMEA	1.2	1.2	1.2	1.2	DAPRAL T210 ₇)	1.6	1.6

Examples 11 to 14

Table 5: Composition of the coating compositions of

modifed dimethylpolysiloxane copolymer from Byk
4) Commercial additive based on a polysiloxane-
polyether copolymer from Goldschmidt
5) Commercial isocyanate based on a hexamethylene
diisocyanate aliphthane from Bayer AG
6) Commercial isocyanate based on a hexamethylene
diisocyanate triimer from Rhone-Poulenc
7) Nonionic polyurethane thickeener (10% strength in
water) from Akzo

Table 6: Test results for the coatings of Examples 1 to 10 and of Comparative Example 1

Example	Blister-ing	Haze	Swelling	Blister-ing	Haze	Swelling	Hardness RT	Hardness 30°/60°C
1	$m4/g0-1$	0	1	0	0	0-1	108	131
2	$m4/g0-1$	0	1	$m3/g0-1$	0	0-1	80	117
3	0	0	1	0	0	0-1	98	132
4	$m4/g0-1$	1	1	0	1	0-1	107	141
5	0	0	1	0	0	0-1	116	140
6	$m5/g0-1$	0	1	0	0	0-1	108	131
7	$m4/g0-1$	0-1	1	0	0	0-1	107	132
8	$m5/g0-1$	0-1	1	$m3/g0-1$	0-1	0-1	81	121
9	0	0-1	1	0	0	0-1	107	129
10	0	0-1	1	0	0-1	0-1	116	129
V1	$m5/g1-2$	1-2	2	$m3/g1$	1-2	1-2	106	124

Example	Constituent	cliffmate	best	Blistering	Note
11	12	13	14	0	0 days
2	2	2	2	0	Swelling
-	-	-	-	-	Note
- all films show a fine graininess and slight loss of gloss.	-	-	-	-	-
- sample 3 is visually the best.	-	-	-	-	-
2	2	2	2	0	Swelling
-	-	-	-	-	Note
- all films show a fine graininess and slight loss of gloss.	-	-	-	-	-
- sample 3 is visually the best.	-	-	-	-	-
3	3	3	3	0	Swelling
-	-	-	-	-	Note
- do not darken so much as the prior art.	-	-	-	-	-
- very fine graininess and fine blisters.	-	-	-	-	-
-	-	-	-	-	-
3	3	3	3	0	Swelling
-	-	-	-	-	Note
- all films have undergone a relatively high degree of matting.	-	-	-	-	-
-	-	-	-	-	Note
Regeneration	Blistering	g1 / m1-2 / m1 / g1	g1 / m1-2 / m1 / g1	m1 / g1	Note
-	-	-	-	-	-
glosses have receded almost to the initial values.	-	-	-	-	-

Table 7: Test results for the coatings of Examples 11 to 14

* Tesa = commercial adhesive tape.

Water spray test					Note
- all films exhibit a good gloss and evenness.					Note
0 cycles	Crosshatch	0	0	0	Cross-cut
1	1	1	1	1	1 B
2 cycles	Crosshatch	1	1	1	2-3 B
1 B	Cross-cut	1 B	1 B	2 B	Cross-cut
Note	- all films exhibit a good gloss and evenness.				
2 cycles	Crosshatch	1	2	2	Swelling
0-1	Crosshatch	0-1	1	1	5 cycles
5 cycles	Cross-cut	5 with	5 with	0 with	Cross-cut
4 with	TeSa	TeSa	TeSa	TeSa	Crosshatch
Note	- all films still show good gloss.				
0	Blistering	0	0	0	Swelling
3	Blistering	3	3	3	Regeneration 24 h
0	Crosshatch	0	0	0	Crosshatch
0 with	TeSa	TeSa	TeSa	TeSa	Cross-cut
Note	- all films are exactly like the prior art in evenness and gloss.				

Summary of the test results

5 clearly that the components (I) and (II) which were
premixed as organic formulations produce better
technological properties and exposure to a wet climate
than the mixing of an aqueous component (I) with
organic polycyanate (comparative example VI in
analogy to EP-B-0358 979).

EP-B-0358 979.
Fewer instances of blistering, haze and swelling occur
than in the case of the systems described in

15

In addition, the results in Table 7 show that the use
of butyl glycol gives rise to poorer humid and constant
climate tests. The two variants without butyl glycol,
however, give better visual results (evenness, topcoat
appearance).

20

from 30 to 250 mg of KOH/g and an acid
between 1000 and 30,000, an OH number of
a number-average molecular weight of
organic, water-dilutable solvents and has
dissolved or dispersed in one or more
tanning polyester resin (A2) which is
(A2) at least one hydroxyl- and carboxyl-con-

and/or
number of from 5 to 150 mg of KOH/g,
from 40 to 200 mg of KOH/g and an acid
between 1000 and 30,000, an OH number of
a number-average molecular weight of
organic, water-dilutable solvents and has
dissolved or dispersed in one or more
tanning acrylate copolymer (A1) which is
(A1) at least one hydroxyl- and carboxyl-con-

10 1.) component (I) contains as binder (A)

that
containing crosslinking agent, characterized in
one or more organic solvents, and on an isocyanato-
tanning polymer which is dissolved or dispersed in
polymers and based on a hydroxyl- and carboxyl-con-
1. Coating composition comprising at least three com-

Patent Claims:

per molecule and/or, if desired, at least one pound (F2) having at least two epoxide groups agent consisting of at least one epoxide com-
25 if desired, at least one further crosslinking dispersed in one or more organic solvents, and, cyamate [sic] (F1) which is dissolved or (F) at least one nonblockdi- and/or polyiso-
2.) component (II) contains a crosslinking agent

25

20

2.5 dPAs,
propionate has a viscosity at 23°C of <= solution of the binder (A) in ethoxyethyl (A4) being selected such that a 50% strength the binders (A1) and/or (A2) and/or (A3) and/or
15

(A4) if desired, at least one further binder,

number of from 5 to 150 mg of KOH/g, and from 20 to 200 mg of KOH/g and an acid between 1000 and 30,000, an OH number of a number-average molecular weight of organic, water-dilutable solvents and has dispersed or dissolved in one or more taining polyurethane resin (A3) which is
5 (A3) at least one hydroxyl- and carboxyl-con-

5

and/or
number of from 5 to 150 mg of KOH/g,

(A3) and/or (A4) are selected such that a 50%

4.) in that the binders (A1) and/or (A2) and/or

25

<= 3.5 dPa.s, and/or

23°C of <= 5.0 dPa.s, preferably a viscosity of

ethoxyethyl propionate, have a viscosity at

employed which, as a 50% strength solution in

3.) as component (A1) polyurethane resins are

20

<= 1.0 dPa.s, and/or

23°C of <= 2.0 dPa.s, preferably a viscosity of

ethoxyethyl propionate, have a viscosity at

which, as a 50% strength solution in

2.) as component (A2) polyester resins are employed

15

<= 2.0 dPa.s, and/or

23°C of <= 3.0 dPa.s, preferably a viscosity of

ethoxyethyl propionate, have a viscosity at

employed which, as a 50% strength solution in

1.) as component (A1) acrylate copolymers are

10

characterized in that

2.) Coating composition according to claim 1,

5

contains water.

3.) component (III) is essentially binder-free and

amino resin (F3), and

4. Coating composition according to one of claims 1 to

(A1) to (A4) being in each case 100% by weight.

25 the sum of the proportions by weight of components

(A4),

5% by weight, of at least one further binder

(A4) from 0 to 10% by weight, preferably from 0 to

20

resin (A3),

20% by weight, of at least one polyurethane

(A3) from 0 to 30% by weight, preferably from 5 to

15

(A2), and

20% by weight, of at least one polystyrene

(A2) from 0 to 30% by weight, preferably from 5 to

copolymer,

10 80% by weight, of at least one acrylate

(A1) at least 50% by weight, preferably at least

binder (A)

characterized in that component (I) comprises as

5 3. Coating composition according to claim 1 or 2,

≤ 2.0 dPAs.

ethyl propionate has a viscosity at 23°C of

strength solution of the binder (A) in ethoxy-

18 carbon atoms per molecule, and/or
a-branched monocarboxylic acids having 5 to
a4) if desired, one or more vinyl esters of

25

monomers, and
(a4), (a5) and (a6), or a mixture of such
cu_{le} and is copolymerizable with (a1), (a2),
carboxylic acids at least one carboxyl group per mole-
a3) an ethylenically unsaturated monomer which

monomers,
different from (a5), or a mixture of such
[sic], (a3), (a4), (a5) and (a6) and is
which is copolymerizable with (a1), (a2)
cu_{le} and is essentially carboxyl-free, and
carboxylic acids at least one hydroxyl group per mole-
a2) an ethylenically unsaturated monomer which

15

mixture of such monomers,
with (a2), (a3), (a4), (a5) and (a6), or a
(a4), (a5) and (a6) and is copolymerizable
ester which is different from (a2), (a3),
a1) an essentially carboxyl-free (meth)acrylic

10

at least one polymerization initiator,
solvent or a solvent mixture and in the presence of
(A1) is obtainable by polymerizing, in an organic
3, characterized in that the acrylate copolymer

5

pl) polycarboxylic acids or esterifiable

is obtainable by reaction of

4, characterized in that the polyester resin (A2) 25
5. Coating composition according to one of claims 1 to

acid number and the desired molecular weight.

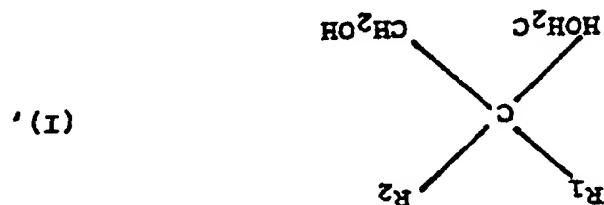
polyacrylate resin (A1) has the desired OH number, 20
selected in nature and quantity such that the
(a1), (a2), (a3), (a4), (a5) and (a6) being

(a4) and (a5), or a mixture of such monomers,
and (a5) and is different from (a1), (a2),
copolymerizable with (a1), (a2), (a3), (a4),
15 ethylenically unsaturated monomer which is
a6) if desired, an essentially carboxyl-free,

having 5 to 18 carbon atoms per molecule,
ester of an α -branched monocarboxylic acid 10
polymerization reaction, with the glycidyl
then reacted, during or after the
acrylic and/or methacrylic acid, which is
5 reaction product, an equivalent quantity of
atoms per molecule or, instead of the reaction
monocarboxylic acid having 5 to 18 carbon
glycidyl ester of an α -branched
acrylic acid and/or methacrylic acid with the
a5) if desired, at least one reaction product of

R₁ and/or R₂ may not be methyl, and/or
cycloaliphatic radical, with the proviso that
1 to 18 carbon atoms, an aryl radical or a
different radical and are an alkyl radical of
in which R₁ and R₂ are each an identical or

20



a1) at least one diol of the formula (I)

consists at least to a certain proportion of
obtainable by employing an alcohol component which
5, characterized in that the polyurethane resin is
6. coating composition according to one of claims 1 to
10

15

if appropriate, (p3).

which the reaction product of (p1), (p2) and,
p4) if desired, a component which is reactive

p3) if desired, further modifying components, and

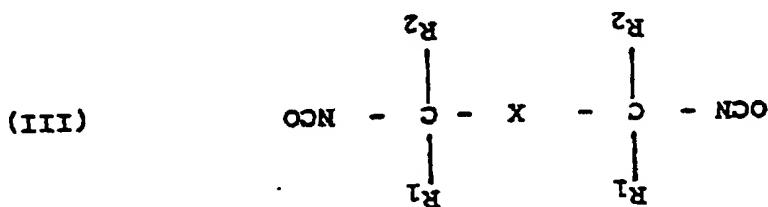
10

p2) polyols, together if desired with monooles,

5

monocarboxylic acids,
derivatives therefore, together if desired with

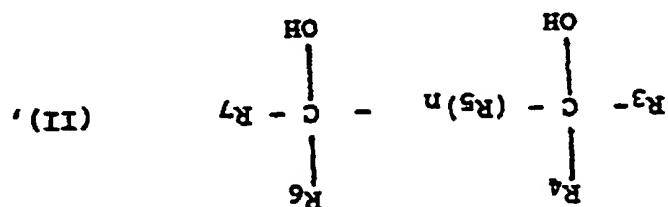
are an alky radical of 1-4 carbon atoms, preferably a 1,3-phenylene radical, and R₁ and R₂ 15 are methoxy-substituted naphthylene, diphenylene or 1,2-, 1,3- or 1,4-phenylene radical, particularly radical, preferably an optically halogen-, methyl- in which X is a divalent, aromatic hydrocarbon



formula (III):

10 and/or by employing diisocyanates of the general

to 6 carbon atoms, and n is either 0 or 1, 5 radical or an unsaturated alky radical of 1 alky radical of 1 to 6 carbon atoms, an aryl alky radical or an aryl radical, and R₅ is an radical or an aryl radical, and R₅ is an radical of 1 to 6 carbon atoms, a cycloalkyl radical of 1 to 6 carbon atoms, and are an alky or different radicals and are an alky in which R₃, R₄, R₆ and R₇ are each identical



82) at least one diol of the formula (II)

preferably a methyl radical.

7. Coating composition according to one of claims 1 to 6, characterized in that component (II) comprises

(F1) at least 70% by weight, preferably from 80 to 100% by weight, of a nonlocked di- and/or polyisocyanate (F1),

(F2) from 0 to 30% by weight, preferably from 2 to 20% by weight, of at least one epoxide compound (F2) having at least 2 epoxide groups per molecule, and

(F3) from 0 to 30% by weight, preferably from 2 to 20% by weight, of at least one amine resin

(F3),

20 based in each case on the overall weight of the crosslinking agent (F).

7, characterized in that component (I) comprises

8. Coating composition according to one of claims 1 to

25

to 80% by weight, of the binder (A),

(A) from 20 to 90% by weight, preferably from 35

20

based in each case on the overall weight of the

15

per molecule, and

20% by weight, of at least 2 epoxide groups

20% by weight, of at least one epoxide compound

(F2) from 0 to 30% by weight, preferably from 2 to

10

polyisocyanate (F1),

100% by weight, of a nonlocked di- and/or

(F1) at least 70% by weight, preferably from 80 to

5

as crosslinking agent

6, characterized in that component (II) comprises

7. Coating composition according to one of claims 1 to

water-miscible solvent, and
to 40% by weight, of at least one organic,
(G) from 0 to 50% by weight, preferably from 10

25

crosslinking agent (F),
to 90% by weight, of at least one
(F) from 50 to 100% by weight, preferably from 60

20

component (II) comprises
(A) to (B) being in each case 100% by weight, and
the sum of the proportions by weight of components

auxiliary and/or additive,
(E) from 0 to 20% by weight, preferably from 2 to
10% by weight, of at least one conventional

15

agent,
(D) from 0 to 20% by weight, preferably from 2 to
10% by weight, of at least one neutralizing

10

water-dilutable solvent, and
to 40% by weight, of at least one organic,
(C) from 5 to 50% by weight, preferably from 10

5

filler,
(B) from 0 to 60% by weight, preferably from 5 to
50% by weight, of at least one pigment and/or

8. characterized in that components (I) and (II)
9. coating composition according to one of claims 1 to

25 (I) to (L) being in each case 100% by weight.
the sum of the proportions by weight of components

20 (L) from 0 to 20% by weight, preferably from 0 to
10% by weight, of at least one emulsion

15 auxiliaries and/or additive, and
(K) from 0 to 20% by weight, preferably from 2 to
10% by weight, of at least one conventional

10 agent,
(J) from 0 to 20% by weight, preferably from 2 to
10% by weight, of at least one neutralizing

10 (I) from 80 to 100% by weight, preferably from 80
to 95% by weight, of water,

5 (F) to (H) being in each case 100% by weight, and
the sum of the proportions by weight of components

auxiliary and/or additive,
(H) from 0 to 20% by weight, preferably from 0 to
10% by weight, of at least one conventional

11. Use of the coating compositions according to one of

(IV) are added.

25 and then components (II) and, if desired, to the component (I) obtained in this way, component (III) or component (III) is added (ii) the resulting component (I) is added to

20 or (III)

the mixture obtained is added to component and then either component (III) is added or with components (II) and, if desired, (IV), (i) the resulting component (I) is then mixed

15 are dispersed in this binder solution, and either prepared, the further constituents of component (I) organic, water-dispersible solvent is first of all sized in that a solution of the binder (A) in the 10. Process for the preparation of the coating compositions according to one of claims 1 to 9, characteristics are dispersed in this binder solution, and either

5 1:1.2 and 1:1.5.
(F) is between 1:2 and 2:1, preferably between the crosslinking groups of the crosslinking agent equivalents of hydroxyl groups of the binder (A) to are present in quantities such that the ratio of

Patent Agents
Ottawa, Canada
Fetherstonhaugh & Co.,

13. Use of the coating compositions according to one of claims 1 to 9 as topcoat and/or filler.

12. Use of the coating compositions according to one of claims 1 to 9 in the coating of plastics.

11. Use of the coating compositions according to one of claims 1 to 9 in the definitive refinishing.

5

Abstract

The present invention relates to a coating composition comprising at least three components, characterized in that present invention relates to a coating composition comprising at least three components, characterized in

5 that

component (I) contains as binder at least one acrylate

10 copolymer which is dissolved or dispersed in organic

solvent and has a number-average molecular weight of

between 1000 and 30,000, an OH number of from 40 to 200

15 and an acid number of from 5 to 150 and/or polyester

resin having a number-average molecular weight of

between 1000 and 30,000, an OH number of from 30 to 250

20 and an acid number of from 5 to 150 and/or polyurethane

resin having a number-average molecular weight of

between 1000 and 30,000, an OH number of from 20 to 200

25 and an acid number of from 5 to 150, and, if desired, a

further binder, the binder components being selected

such that a 50% strength solution of the binder in

20 ethoxyethyl propionate has a viscosity at 23°C of

component (II) contains at least one nonlocked

25 polyisocyanate [sic] as crosslinking agent, and

component (III) is essentially binder-free and contains

water.

25

<= 2.5 dPa.s,

20

and an acid number of from 5 to 150, and, if desired, a

25 further binder, the binder components being selected

such that a 50% strength solution of the binder in

20 ethoxyethyl propionate has a viscosity at 23°C of

component (II) contains at least one nonlocked

25 polyisocyanate [sic] as crosslinking agent, and

component (III) is essentially binder-free and contains

water.